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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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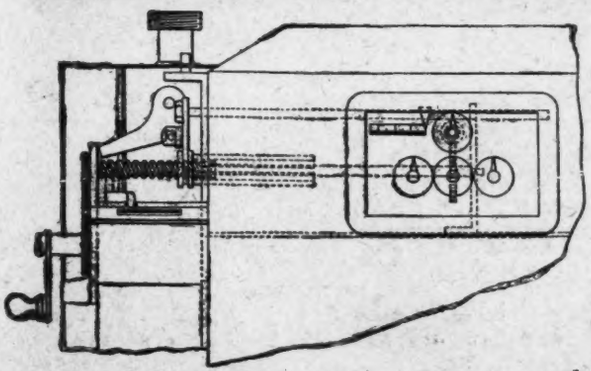

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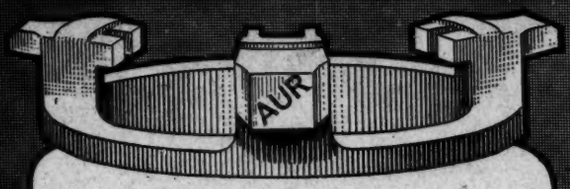

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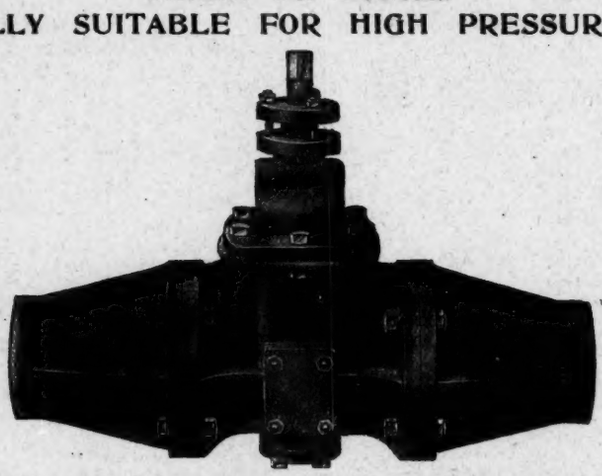

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EDITORIAL NOTES.

Thermal Efficiencies of Gas and Electricity in Relation to Coal Economy.

THE liberties that certain Committees who have been reporting upon electricity supply have taken with facts and truth in their reports, to the misleading of the Government and the country (including newspaper writers with more imagination than technical competence to form judgment and test conclusions), are being exposed in a manner which will not be to the taste of a good many interested people. But it is hoped this will render national service by letting the Government and the country know the actual position. The Power Sub-Committee of the Coal Conservation Committee confined themselves in their report to advising the Government regarding electricity supply; and they produced distinguished looking figures to show the economy of coal that would result if what is now used was converted into electrical energy, and then transmitted freely about the country for power and heating purposes—both industrial and domestic. No such savings could ever be secured by changing-over from solid fuel to electrical energy for general power and heating purposes, particularly heating. There was also a grave omission in the report, in that the Power Sub-Committee did not point out that much greater coal economy could be achieved through the gas industry than through the electrical industry. Never (more especially in respect of heating) was a more brutal assault made upon coal "economy" and "conservation" than in this report. Instead of economy, it is the easiest thing in the world to prove that the conversion of the heat energy of coal into electrical energy and the conversion back again into heat is a piece of monstrous prodigality and folly which no scientific man should tolerate, but should denounce to the utmost of his power.

The gage was thrown down to the Government and to the electricians by Sir Dugald Clerk, at the meeting of the Society of Arts last Wednesday, in the paper he read on the "Distribution of Light, Heat, and Power by Gas and Elec-"tricity." No one could deal with the matter with greater authority or assurance than Sir Dugald. The question was examined by him from the standpoint of whether in light, heat, or power, the gas or the electricity industry makes the best use of the heat energy of coal; and the paper challenges electricians to show, if able, that the figures have no title to acceptance and are not worthy of credence. There were several electricians at the meeting—among them Mr. Patchell and Colonel Crompton. Neither of them questioned the validity of the data. They did well; for Sir Dugald, they knew, is not in the habit of being caught napping over matters of this kind. Mr. Patchell discreetly avoided figures, and wanted to know how it was, in connection with power, that so many electric motors had been established in munition factories during the war. The reply to that is, the same reason that led to the installation of the enormous number of gas-furnaces in such factories—quick installation and convenience. He also suggested that, if Sir Dugald had taken his comparison on a financial basis, he would have found something different. True, and to the disadvantage of the electricity industry. The case would, if anything, have been distinctly worse—more particularly in the realm of heating. In this connection, Colonel Crompton spoke of the value of the portable electric-radiator for giving warmth to old people and invalids. Again, there is no disputing this. There is no contention that in heating there are special purposes where electricity is not only useful, but valuable. We are, however, talking about utilizing coal to the best advantage in the national interests, and warming the mass of the people—not merely old people and invalids who want to be fenced in by radiators. The nature of the remarks made by Mr. Patchell and Colonel Crompton constituted the best possible compliment that could be paid to Sir Dugald upon the substance of his paper.

Where high concentrated temperatures are required in some forms of industrial operations, electric heating is an advantage; but, nationally considered, the use of electricity for ordinary heating purposes is, as Lord Moulton (who presided at the meeting) put it, a "ghastly waste." Take the efficiency of the average generating station to-day. There is a loss of heat energy of something like 90 p.ct., or rather more; and under the best of predicted circumstances the loss will be 80 p.ct., or more. At present, the actual efficiency of the gas industry, on the basis of the heat energy in the coal it utilizes, is—taking count of gas, coke, and tar, and not taking any credit for the other products—close upon the 80 p.ct. representing loss in the electrical industry; and, with the developments that are taking place, the industry is moving to the neighbourhood of 90 p.ct. efficiency. If any would-be critics who have no firm knowledge of these matters are not prepared to accept Sir Dugald Clerk's data, they will find in the Cantor Lecture of Prof. Bone [p. 632], who is a scientist and economist of unimpeachable independence, complete confirmation of the efficiency of modern gas-works processes. This advance in the efficiency of gas-works practices—the additional heat units per ton of coal that are being distributed through gas-mains in some areas, and will be distributed to a more considerable extent as time passes—will still further widen the breach between the low efficiency of electricity and the high efficiency of gas production; and this will also make its impression on relative costs. Sir Dugald did not in his comparison stop at production efficiencies, nor at the point where he showed that, if the electricity industry was supplying to the country the same amount of heat as the gas industry, it would be to-day using 58·5 million tons of coal, which is a quantity that would swamp several times over the amount used by the gas industry. Electricity is not, therefore, the road to coal conservation; it is the road to coal dissipation. In the examination of the position of room heating, water boiling, cooking, metal melting, and power, we were shown that, from the thermal efficiency standpoint, electricity steadfastly maintains its inferiority. Only in lighting, by using the misnamed dazzling half-watt lamp, does it realize an equality with gas at all ordinary pressures. But there, on the financial basis, light for light, gas does not fear it. As to the power position, no man can speak with greater authority than Sir Dugald; and with the confidence he possesses, he did so dispassionately.

We will not traverse here the whole of the complete data presented in the paper; but if the electrical people cannot prove inaccuracy, then the basis of the reports that have emanated from the Board of Trade and the Ministry of Reconstruction is undermined, and the Government scheme has not the support which the political mind believed was there, but which the expert mind knew well did not exist. Before the Government proceeds, there really ought to be another inquiry into the causes which led the two Committees to make their reports in the form they did. Had the reports been confined to the utilization of electricity for transport purposes, there would have been greater reason for them. Sir Dugald Clerk, Lord Moulton, and others are, like the gas industry, only out for the truth. Electricity has enormous uses. The gas industry, where it is more convenient to use electric motors than gas-engines, do so; but where gas-engines are equally convenient and less costly in running, they are used. Gas, too, has enormous uses,

especially in heating; and where it can serve the national interests with greater economy than another agent, it objects to the position being assailed by false pretences and misconception. As Sir Dugald well says, from the national and coal economy points of view, where the conditions permit, gas and electricity generation should be combined in one works, so that heat waste could be greatly reduced by the combination of gas-making and steam-raising as one unit. Great heat economies could be obtained in this manner. As, however, things are moving, through the aid of political ignorance, the roads along which the two industries are passing are diverging more widely, and unity in the work of production appears farther off than ever. The result is increasing waste of the national resources.

Gas Problems—Prof. Bone Pleads for a Complete Investigation.

The second of the Cantor Lectures by Professor W. A. Bone, published this week [p. 632], will, we think, be accounted the most important of the three from the point of view of the gas industry. It was a deliverance of many and weighty parts, from the standpoint of a distinguished scientist who has made fuel his primary study. We find in the lecture many points which will give to the men of the industry a large amount of gratification, for they show that, though the Professor believes that there is some place at which a line should be drawn in our gas-producing practices, modern developments are of a character which merits his approbation. But after all is said and done, it must be admitted that in the industry our technical affairs, as well as our financial position (this through the war, and the changes effected by it), are in an unsettled position—in a state of flux, so to speak. And towards the close of the lecture, the Professor pleads for the appointment of a thoroughly competent Committee—not a Committee selected solely by the gas industry, nor an ordinary bureaucratic Committee, but a thoroughly scientific Committee—to determine and put on to a stable foundation the technical work of gas production in relation to the gas to be produced and supplied. We have argued for many months past for something of similar kind, but with larger scope, because gas production and supply, legislation, and finance are so interrelated in the gas industry, and its position in all these respects is so unsatisfactory to-day, that the limits of investigation cannot be confined to any one aspect of the situation. Therefore, our advocacy of a composite Committee of competent men. There will be no difficulty we think in gaining the adherence of Prof. Bone to this view, inasmuch as, in the early part of his lecture, when dealing with the use of coal, he pointed out that, while thermal efficiency is a dominating factor, the total economic result must be the deciding factor; and he then proceeded to say: "This is not always understood by so-called "scientific people—in fact, commercial people often take a "more scientific view of these questions than the scien-"tific man. They look at more factors than the scientific "man."

It must be admitted that the investigation to which the gas industry is being subjected at the moment is of a piecemeal and disjointed order. It is being carried on in different directions without any attempt at co-ordination. The Institution of Gas Engineers have in hand the preparation of a statement dealing with coal economy in relation to the report of the Power Sub-Committee of the Coal Conservation Committee; there is the research by the Gas Investigation Committee of the Institution and the Leeds University; there is the investigation by the Fuel Research Board, and its recommendations as to the future gas supply of the country; and individuals are also experimenting in different directions. It cannot be claimed—however useful all this work may be—that it is of that systematic, comprehensive, and high order that is desirable to place the operations of the industry upon the surest of ground. As we understand Prof. Bone, the importance of the future gas standard is such that he considers the question ought to be investigated very deliberately in all its bearings—economic, technical, and scientific—if mistakes are to be avoided; and we discern in his remarks the feeling that there is a dangerous tendency to rush through this matter at a time when men's minds have hardly recovered from war strain, and are still in a state of tension owing to the serious labour and economic situation with which the country is faced. We quite admit the time is not favourable for that calm and deliberate study which the question ought to receive. At the same time, there are other considerations, born of the extremely awkward economic situation in which the industry finds itself (particularly in regard to coal), and which demands that it shall bring into account at once all benefit that can be secured to alleviate the position.

What the industry should have is a respite of fairly considerable duration from standards and conditions to an extent that will allow it to take advantage of all the advances made during recent years, so as to lighten as far as possible the new burdens. They are here, and are substantial, and will continue so. All we have in hand at present to meet them are those advances, as and when they can be brought to make effective contribution. One of them, it is quite clear from the lecture, appeals to Prof. Bone, and meets with his approbation. That is the higher thermal efficiency secured in the gas produced by the system of steaming charges, by which (in one test he quoted) with a make of 16,600 c.ft. of gas, 28 p.ct. of the heat value of the coal was transferred to the gas, as compared with 23 p.ct. before steaming. Still higher results have been obtained, at a relatively small sacrifice of B.Th.U. per cubic foot, but a good gain per ton of coal used, and giving a satisfactory gas for general consumption. If, therefore, something could be done to preserve to the industry economies which would be of service to it and its consumers, it would be a commonsense thing to comply with the plea of Prof. Bone for complete investigation by a fully competent tribunal (which would be entirely acceptable to the Government) before finally determining the basis of the industry's future operations. The point is one that should receive the serious attention of the industry; for as things are, and as they are proceeding, finality appears to be a long way off. The sooner we can get a "move on" in the shape of a systematic, penetrating, conclusive inquiry, the better. The outlook in regard to producing and working costs has become more ominous than ever the past few days.

That is the question of outstanding importance raised in the second of Prof. Bone's lectures; but all its components are of interest. As already remarked, the lecturer looks with much favour on steaming in vertical retorts. Without steaming, he shows a heat-balance for the vertical system amounting to 89 p.ct., and more with steaming. He believes in increasing the potential heat in the gas realized per ton of coal; and he sees considerable possibilities in this direction. But there is an indication that he is not particularly smitten, for town gas purposes, with the idea of completely gasifying coal. And one reason for this may perhaps be looked for in the part of the lecture where he deals with the proposal to charge for gas on the heat-unit basis, instead of by volume, and proceeds to discuss the matter in regard to gas composition. As a chemist, he is opposed to avoidable inerts being supplied through gas-mains to the consumer. Further, he is not satisfied that the commercial prospects of low-temperature carbonization are very great at present. But for the gas industry, he sees a fine field for the future in carbonizing more of the coal used in domestic fireplaces and in industrial furnaces. The gas and the coking industries between them at present carbonize only about 17 p.ct. of the total home coal consumption. They ought to be able to carbonize 45 p.ct. At any rate, Prof. Bone hopes that the 17 p.ct. will soon be raised to 25 p.ct. The fulfilment of the hope is one of the most earnest desires of the gas-supply industry to-day.

Organization for the Protection and Advancement of the Interests of Technical Gas Officials.

There are exceptions to the payment of poor salaries to the technical officials of gas undertakings; there are, we are sorry to say, more exceptions to the payment of the good salaries that are deserved for the services rendered. This anomalous position of things is now being accentuated day by day by the higher wages and the shorter hours that the craftsmen and general workers of the industry are securing. The time has come for remedial measures. The cost of living has risen as much, and more so, for gas officials as for the workers. Education, qualifications, and responsibility are all, and must be, of a higher order for the former than for the latter; but the administrators of many works—these administrators are real enemies to the best interests of the industry—appear to be totally blind to these conditions, or will not recognize them while the officials themselves remain dormant. The reason that the officials are in an inferior position to the workers in pressing their claims is that they have no organization like the workers to force home what

is only clear justice. Administrators should recognize that good salaries attract the best men—men of brains, qualification, and experience; and, forsooth, the industry to-day wants such men badly in every quarter of it. Indifferent salaries often succeed in securing indifferent men; and these men, unless they are exceptionally lucky, are able to lose much more money by poor quality management than would have to be paid to a really first-class man. This is a matter upon which we have often commented. The needs of the industry are such that the subject must not be allowed to drop, and parsimony be permitted to injure the movement for realizing, under heavy adverse conditions, the promise of the future for the industry. In a later column to-day is a letter suggesting that a better state of affairs can only be brought about by a combination of engineers and managers, works superintendents, and assistants in one organization for their protection and advancement. If such an organization can do effective work, then it would be not only in the interests of the officials, but obviously in those of the industry itself. There would have to be complete organization. The men who are in positions in which they are suitably rewarded should not regard this fact as a reason for excluding themselves from participation in the raising of the standard of recompense for other technical officials. They are the very ones whose assistance would be valuable in helping those in circumstances that are less attractive than their own; and professional position has its obligations. The electrical engineers have an organization (we believe it is known as the Electrical Power Engineers' Association) which has what the technical organizations have not—the power to deal with matters that partake of the nature of those in which trade unions concern themselves. To help to advance the suggestion as to a similar organization for technical gas officials, we shall be pleased to forward any communications—addressed to "Anonymous," care of the "JOURNAL"—to the writer of the letter, so that the necessary nucleus for bringing the proposal to a head may be obtained without individual publicity, which obviously in many cases would be inadvisable.

The Government-Accepted Coal Report and the Price of Coal.

THERE will be mixed feelings in industries dependent on coal as their chief "raw" material, such as the gas industry, over the three reports that have been issued by the Coal Commission—in the first place because (this was hardly expected in view of the unyielding spirit in which the miners' representatives entered upon the work) the result is not an unanimous report, and, in the second place, because, however one looks at the only report which shows impartiality and a judicial consideration of the evidence placed before the Commission, the one conclusion that can be derived from it is that the price of coal at the pithead will have to be maintained for some time to come, and then the only prospect of any reduction will be from those at present amorphous improvements and economies which are foreshadowed, and which, if they come at all, will be of comparatively slow growth. The public have had the opportunity of reading the reports of the evidence laid before the Commission; and the public will have no hesitation in saying that the report of Mr. Justice Sankey and three of his colleagues (one of whom is Sir Arthur Duckham, K.C.B.)—the most independent of the Commissioners, representing as they do the industrial consumers—is statesmanlike and conciliatory. While granting the miners a considerable part of what they have asked for, it also provides them with the opportunity, within measurable time if economic conditions will permit, of realizing practically all they demanded so far as wages and hours are concerned, and, furthermore, concedes to them the principle of having a voice in the control of the industry (whether nationalization or collective control be the choice of Parliament), together with the limitation of the profits of the coalowners to 1s. 2d. per ton. At the same time, the recommendation is made that 1d. per ton on the coal raised should be set aside for providing better housing accommodation and working conditions. It is a revolutionary report, though only an interim one. While we may not agree with it in its every part, it can be said that it is constructive; and it supplies precedents which may become far-reaching. In part, it is a condemnation of the past management of the collieries, and will be anything but appreciated by the coalowners.

The concessions in the accepted report of additional wages and shorter working time (and upon these the Government, Mr. Bonar Law says, intend to stand firm) are: A seven-hours' day for underground men from July 16 this year, and a reduction to a six-hour day from July 13, 1921, subject to the economic conditions at the end of 1920 allowing it. The miners' representatives would not, in their report, shift from their demand for a six-hour day; while the coalowners, in their report, also conceded a seven-hour day, but made no provision for a six-hour one. Surface men are conceded a 46½ hours' week from July 16. The accepted report gives to the colliers an increase of 2s. per day, and to boys 1s. The coalowners proposed respectively 1s. 6d. and 9d. The miners' representatives did not waver from the 30 p.ct. increase originally demanded. The extra cost of the concessions in the current year is estimated at £43,000,000. The difference between the owners' limited profit and the profit which, under present circumstances, might be obtained is some 39 millions. The fall in the value of exported coal will probably take away 9 millions. On this basis, 30 millions (which absorbs excess profits) will be available towards meeting the increased cost; and the country will be left with an additional burden of 13 millions. In these circumstances, the hope of any immediate reduction of price at the pit head must be abandoned; and the gas industry have another solid argument to apply to their case for substantial financial relief. [Since the foregoing was written, the miners have submitted some amendments to the Sankey report. The first one is to the effect that the flat-rate of 2s. should be increased to 2s. 6d. This it is estimated would mean £25,000 extra per day, which we calculate, on a five days' working week, would mean another 6½ millions a year. Then they want to ensure no doubt as to eventually securing a six-hour day, and so ask for the deletion from the report of the words "subject to the economic "position of the industry at the end of 1920," and desire the six-hour day brought forward to July, 1920, instead of July 13, 1921. They also want the six days' bonus payment of 2s. for five days' work in all districts where the workmen on the second or afternoon shift are paid six days' wages for five days' work.]

The miners' claim a right to take part in the control of the collieries. Such a claim can only be justified by a competence to take part. If they are competent for such work, then they must know—quite a simple arithmetical calculation shows it—that nothing but the maintenance of the price of coal at the present high level can meet the concessions that have been made by Mr. Justice Sankey and those of the Commissioners who agree with him. The report itself goes no further than saying that "it is thought that these results "may be obtained without raising the price of coal to the "consumer." There is no confidence here; only hope and supposition. And it will be a long time ahead before benefit can accrue from the plans yet to be prepared, considered, and adopted for materializing latent economies, and obtaining a larger coal output by a more extended introduction of mechanical operation and transport. Perhaps, for future peace and future prosperity, it is as well now to face this condition, though the time—strategy is not absent from trade union movement—is the worst possible. All other industries are at the present time in a maimed state, and the new conditions in the coal industry will contribute very largely to them remaining so. And yet never was there a time when the country required so much from industry to help to restore its fortunes. Through the changes that are coming over the coal industry, the Coal Control Department will have to continue its work for some considerable time to come.

The economy schemes, nationalization, and control are questions that have yet to receive the attentions of the Commission. But if the miners strike, the work of the Commission will come to an immediate end, and the concessions made will in that event fall, and things be restored to the position that they were in before the sittings of the Commission began. The men would be foolish to throw over the extraordinary gains they have secured under the report; and Mr. Smillie realizes this. But they are as keen as ever for nationalization. "Nationalization" indicates that this is a question for the nation; not for a relatively small section of it. The miners, however, claim an exclusive right to determine this question; while they have no right to do anything more than share in its settlement. The Government are expected to buy out the coalowners. The Government are the representatives and the trustees in this matter for the whole country; and the whole country, and

not the miners only, ought to have a voice in such an enormous reversal of policy. However, a great change of some kind is bound to come. It is foretold in the report already issued. Whatever it may be, it is hoped that it will bring to an end the constant unrest that has prevailed in the coal industry, and all of which cannot, after what has been revealed before the Coal Commission, be attributed to the miners. The owners are not above deserving some censure; and the views expressed by Mr. Justice Sankey and his adherents indirectly administer it.

At the time of writing, the menace of a strike is still about us; but it is not so heavy. The strike notices are in suspension until to-morrow; and thus the position is brighter. Good counsels are being disseminated among the miners. Mr. Smillie himself is favourable to the acceptance of the Government adopted report, with the amendments noted above. One change has already been agreed to. This is the redemption of the promise made a short while ago by Mr. Bonar Law, that any increase of wages resulting from the work of the Commission should be made retrospective from January last. This retrospective payment should be provided out of the excess profits that have already flowed into the Treasury, and not be a charge upon the consumers. Any attempt to advance the charges against consumers after the disclosures before the Commission as to the increase of profits per ton during the period the country was groaning under the burden of expensive and hard-to-get fuel, would only result in loud expression of public indignation.

Another cloud hangs over the country in the railway position. But here again at the moment of writing negotiations are being continued through the steadying influence of the Triple Alliance. With the miners and transport workers approaching close to an agreement, and with the offer of the Government to the railwaymen, which places upon the country a large additional burden, we ought to be saved from such a catastrophe as a stoppage of our railway systems. There is also in this case talk of economies helping to meet the bill; but necessary increases of railway rates are coincidently being hinted at. At the same time traders are calling for cheaper conveyance. A favourable answer to this call is certainly not encouraged by the circumstances before us.

Gas Charges on the Heat Unit Basis.

The proposal of Mr. Charles Carpenter, D.Sc. [see p. 565 last week], that gas charges should be based on the heat unit value of the gas, was commented upon by Prof. W. A. Bone in his second Cantor Lecture, which is fully reported on other pages of the "JOURNAL" this week. He regards the proposal as an extremely fair one; but he holds that other considerations should accompany it. For instance, it is not a matter of indifference how the potential units in gas are present; and he rather condemns as chemically unsound the dictum that "one B.Th.U. is as good as another." From the consumer's point of view, this depends on the company the B.Th.Us. keep. There is a point, Prof. Bone submits, at which it becomes good policy to draw a line as to the constitution of gas supplied to the consumer; and here he gives an instructive little dissertation on the subjects of the range of explosibility and safety of methane and hydrogen and of hydrogen and carbon monoxide. All this is chemically true. But it has to be considered in relation to economical production and practical experience. The calorific power and the composition of gas have varied considerably during the war; and there has been no upward flight in "casualties" as the result of this, nor have the registered complaints from consumers been of an inordinate character. Until the industry had got into good stride with oil-washing, and found how to deal with a new condition of gas, there was an excess in the complaints as to naphthalene troubles. But this was corrected. In several places gas has been supplied varying in calorific power between 400 and 500 B.Th.U.; and much more gas has been sent out per ton of coal handled. To Prof. Bone's points in this relation, we have to apply practical experience, while not disputing their chemical accuracy. Gas production under the higher levels of costs will have to effect a compromise between chemical refinement and economy.

Gas Workers' Hours.

The National Federation of General Workers do not seem inclined to effect any compromise over their demand for a forty-four hour week for gas workers. They appear totally unwilling to consider the question of the inconvenience and costliness of a departure from the forty-eight hour week, which the representatives of the industry had offered to all sections of its employees. A conference of the delegates of the Federation last Tuesday rejected the offer; and the forty-four hour week and nothing over it will satisfy them. If a settlement is not arrived at within a fortnight from the date of the conference, then a ballot is to be taken to determine the action to enforce the claim. That is the position. Obviously, it is a delicate one. Mr. James O'Grady, M.P., the Secretary of the Federation, thinks the employees will consider the position very seriously; and that a settlement ought to be reached within a few days. The employers have already been giving the position very serious consideration. A curious statement made by Mr. O'Grady (over which one pauses) is this: "The men have been working the forty-eight hour week for the last twenty years; so that the public will see that their demands are not unreasonable." Not all sections of gas employees have been working a forty-eight-hour week; but that a large number of workers have been doing so is a matter to the credit of the gas industry, and not a reproach. Because the industry has been doing so long something which other industries are only now conceding does not by any means cloak with reasonableness the demand for four hours a week less. It is all the more reason why the men should consider expediency and working convenience from the point of view of the industry that has for so many years kept them at work a reasonable number of hours per week.

Centralized Sale of Sulphate of Ammonia.

It has become strongly apparent that the sulphate of ammonia market is going to meet doubtful times, through increased competition both at home and abroad; and a very firm hold will have to be maintained over whatever position may arise, in order to control the home market, and to develop markets abroad for all the surplus production. The Sulphate of Ammonia Association have drafted a scheme for forming a Central Selling Organization, with a loan capital provided by makers, for the purpose of marketing sulphate—ultimately one standard quality, in the most perfect condition, and under a distinctive brand. The scheme involves the pooling of prices, with special allowances to individual producers for quality and storage capacity. The full details of the scheme are set out in our news columns; and makers will do well to thoroughly consider them—always remembering the competitive times ahead.

American Gas Association Conference.

The latest periodicals to hand from the other side contain details of the programme arranged for a special conference of the American Gas Association, which was summoned for the 13th and 14th inst. at Hotel Astor, New York. Particular interest was evinced in this fixture, as it was the first gathering of the Association since its formation last June. The advisability of creating an Advertising Section (to include in its membership the publicity, advertising, and display men of gas and manufacturing companies) was to be thoroughly discussed. The ruling of the Executive Board was that such a section should be formed provided at least fifty members made written application for it to be done, and that the action was approved at the special conference. The address of the President (Mr. George B. Cortelyou) was expected to review the important part which gas companies and individuals in the industry took in helping the nation during the war. A number of papers had been promised; and a feature of the programme was "An Open Discussion on Topics of General Interest to the Industry." The Industrial Fuel Committee had agreed to recommend to the Executive Board that an appropriation of $1000 be made available to the Committee for the carrying out of such special work as the testing and development of gas appliances, &c. The list of activities which this Committee hope to undertake during the year is a long one; and among the more important heads are: To carry on investigations concerning the application of gas to industrial processes; to investigate appliances and systems; to determine costs with competitive fuels; and to prevent, as far as possible, the sale of inefficient and incorrect gas-consuming appliances.

Temporary Increase of Charges Act.—Orders have been made by the Local Government Board, under the Statutory Undertakings (Temporary Increase of Charges) Act, in favour of the Pontefract Corporation, increasing their maximum price from 4s. to 6s. per 1000 c.ft.; and for the Winsford Urban District Council raising the figure from 5s. to 7s. 6d. per 1000 c.ft. The Board of Trade have made Orders under the Act in favour of the Great Yarmouth Gas Company, the Bridgend Gas and Water Company, and the Thorne and District Water Company; while they have received applications for Orders from the Broadstairs Gas Company, the Gowerton Gas Company, and the Herne Bay Water-Works Company.

THE NATIONAL GAS COUNCIL.

Central Executive Board Meeting.

A MEETING of the Central Executive Board of the National Gas Council was held last Tuesday. It was announced that Mr. D. Milne Watson, the Chairman of the Board, was engaged with a Committee of the National Industrial Conference, and would be delayed in attending the meeting. Mr. THOMAS HARDIE was voted to the chair.

It was reported that the Manchester District had been subdivided into a Lancashire Section and a Yorkshire Section. The representation of these two sections on the Central Executive Board has been announced in the "JOURNAL" [*ante*, p. 513].

Resolutions from District Institutions and Associations of Gas Engineers and Managers with regard to the price of gas oil and to the diversion of coal supplies which are replaced by unsuitable substitutes, were read. It was reported that a deputation had interviewed Sir John Cadman on the 17th inst. in support of previous applications for a rebate to be made in the price of gas oil in stock at gas-works on Dec. 15 last, inasmuch as these supplies had been accepted in order to assist the country during a serious coal shortage. Application was also made for the present price of 8½d. to be further reduced. Sir John Cadman promised to lay the views of the deputation before the Treasury. The meeting passed a resolution urging the Government to expedite the payment of this rebate to gas undertakings, and asking for a further immediate decrease in price, as conducing to reduce the price of gas to consumers.

It was decided to ask the Controller of Coal Mines to make arrangements whereby gas undertakings forced to accept coal from pits farther away from the works than the usual sources of supply should be reimbursed the additional charge for carriage of the coal.

The Government Bill to establish a Ministry of Ways and Communications was considered, together with an explanatory statement prepared for the Council by Mr. Jacques Abady. The Board decided to take action in order to safeguard the interests of the gas industry, which it appeared would be prejudiced by the Bill, if passed.

It was decided to draw the attention of the Controller of Coal Mines to the fact that municipal authorities were being supplied with sea-borne coal, and were selling it to merchants at the price of rail-borne coal—the transaction being subsidized by the Treasury; and that this is unfair to the gas industry, who have to pay the increased cost of the carriage of their coal by sea without any assistance from the Treasury.

It was reported that the Federation of British Industries were considering the formation of a Fuel Economy Committee to deal with the question of solid, liquid, and gaseous fuels for power-producing purposes.

Mr. Milne Watson, on arriving at the meeting, reported that he had been appointed by the National Industrial Conference to represent the gas industry on a Joint Committee of Employers and of Representatives of Organized Workers, which had been set up to consider and report to the Government upon the present unrest and the necessary steps to be taken to safeguard and promote the interests of employers and employed. He also stated that he had given evidence on behalf of the industry before the Royal Commission on the Coal Industry.

Steps taken to secure the removal of the certification of gas-works under the Ministry of Munitions Amendment Act, 1916, were reported.

A standard form of guarantee for gas-meters was laid before the Board, together with a draft letter which the gas-meter manufacturers propose to circulate, and also an amendment proposed by the Life of Meters Joint Committee of the Institution of Gas Engineers. The amendment submitted was approved.

JOINT INDUSTRIAL COUNCIL FOR THE GAS INDUSTRY.

A MEETING was held at the Ministry of Labour last Tuesday, between representatives of the Committee of Gas Employers and of the unions representing gas-works employees, for the purpose of establishing a Joint Industrial Council for the Gas Industry.

The meeting appointed a Drafting Committee, consisting of seven members on each side. The Employers' representatives are as follows:

Alderman Albert Ball (Nottingham).
Mr. William Cash (Bournemouth, &c.).
Mr. Thomas Hardie (Newcastle-on-Tyne).
Alderman F. S. Phillips (Salford).
Mr. R. G. Shadbolt (Grantham).
Mr. Octavius Thomas (Wales).
Mr. D. Milne Watson (London).

The Wolverhampton Gas Company have applied to the Board of Trade for an Order under the Gas (Standard of Calorific Power) Act.

PERSONAL.

Mr. SYDNEY Y. SHOUBRIDGE, whose lifelong connection with the gas industry is well known to our readers, will retire from the service of the South Suburban Gas Company in the course of the next few months, and will be succeeded as Chief Engineer by Mr. JOHN TERRACE, at present Engineer and Manager of the Grimsby Gas Company. Mr. F. G. GORMAN, now Works Superintendent at Lower Sydenham, becomes at the same time Deputy Engineer.

The appointment of Assistant Engineer to the Stretford Gas Company (applications for which were invited in a recent issue of the "JOURNAL") has been secured by Mr. D. T. LIVESEY, who is at present Assistant to Mr. Robert Watson, of Doncaster. The successful candidate, who is the son of Mr. D. T. Livesey, of East Grinstead, was appointed to Doncaster from Tunbridge Wells towards the end of 1917.

Mr. S. W. IBBOTSON, the Engineer and Manager to the Newport (Isle of Wight) Gas Company, is severing his connection with the gas industry; and the Board, in accepting his resignation, expressed their deep regret, and wished him all prosperity in his future career. The position which he is thus relinquishing, Mr. Ibbotson has held for the past thirteen-and-a-half years.

Mr. ARTHUR T. M'DONALD, the Chief Chemist of the Tradeston works of the Glasgow Corporation Gas Department, and the Hon. Secretary of the Scottish Junior Gas Association, Western District, has been appointed Assistant to Mr. James Kincaid, the Manager of the Kirkcaldy Gas Department.

In the new Government scheme, the Road Board will come under the Minister of Transport; and at the head of this Department will be General MAYBURY, whose successful career has been followed with gratified interest by readers of the "JOURNAL." Having gained in Kent a thorough practical acquaintance with roads and road problems, he became Engineer to the subsequently formed Road Board; and then, during hostilities, he was sent by the War Office, with the rank of Brigadier-General, to make roads for the armies in France.

M. HENRI KUENTZ, a Director of the Fougères and Mayenne gas undertakings, has been made a Chevalier of the Legion of Honour "for his services—distinguished by great bravery—as an artillery and flying officer."

The Royal Automobile Club and the Commercial Motor Users' Association have undertaken jointly to make the necessary financial provision for a programme of research which has already been begun at Manchester University under the direction of Prof. HAROLD B. DIXON, F.R.S. The scheme of investigation extends to a variety of comparative tests to determine the behaviour of alcohol vapour and the vapours of alcohol-benzol mixtures after firing. The chief object is to ascertain the conditions of combustion or other factors which conduce to the maximum power and efficiency from existing internal combustion engines when run on alcohol or alcohol mixtures. But it is also intended to secure data which will be valuable to designers of new types of engines.

In our news columns to-day, mention is made of the resignation of Mr. H. W. SAVILLE, Engineer, Manager, and Secretary of the Drogheda Corporation Gas-Works—which position he has held for twelve years.

Mr. W. P. LONERGAN, the Manager of Lismore (co. Waterford) Gas-Works, belonging to Messrs. Anderson Bros., has been transferred on promotion to the charge of the firm's Dungarvan Gas-Works.

Mr. H. W. WILLMER, the Deputy-Superintennent of the Bradford Corporation Gas Department show-rooms, has received an appointment as Superintendent of the show-rooms of the Bath Gas and Coke Company. Mr. Willmer has been with the Bradford undertaking for the past fifteen years, during thirteen of which he has been in the show-room. He has been Deputy-Superintendent for five or six years, and has had entire charge for the past six months, during the severe illness of Mr. S. H. Packer, the Superintendent.

OBITUARY.

Mrs. MARY JANE FURNISS, the widow of Mr. Councillor John Furness, for forty years Manager of the Slaithwaite Gas Company, died last week at the residence of her son, Mr. T. E. Furness, of Guisborough. She went there to nurse her son, who was suffering from pneumonia, and herself contracted the disease. Her son is recovering. It will be remembered that Mr. Furniss died eleven months ago after an accident at the works, just prior to his intended retirement.

Much sympathy will be felt with Mr. Joseph Davis, the General Manager and Engineer of the Gravesend and Milton Gas Company, in the loss he has sustained by the death of his son, Lieutenant JOSEPH FREDERICK DAVIS, who died in the Cambridge Hospital, Aldershot, last Wednesday, after undergoing a severe operation for gastric ulcer in the stomach, and was buried yesterday with full military honours in the Military Cemetery, Aldershot. Lieutenant Davis, who was in his 26th year, was educated at the Dartford Grammar School, and upon leaving was articled to his father. Completing his articles, he entered the service of the Gravesend

Gas Company as Assistant Engineer, and remained with them until he joined-up. He was a member of the Eastern Counties Gas Managers' Association, in which he took much interest; and gave great assistance to his father during the time the latter was Hon. Secretary. The deceased officer enlisted as a sapper in the Royal Engineers as early as September, 1914, proceeding over-seas in October of that year. He remained on the Western Front throughout the early and difficult days of the campaign, until the latter part of 1916, when he returned to England to take a Commission in the Engineers. After being gazetted, he again proceeded to France, and was all through the severe fighting and the momentous days of the great German attack in the early part of last year. During these operations he was awarded the Military Cross for most conspicuous gallantry in destroying bridges under fire and in full view of the enemy.

THE LATE MR. CANNING.

An Appreciation.

The late Mr. Thomas Canning [whose death had regretfully to be announced in last week's "Journal"] was a talented and very able engineer, possessing a powerful general grasp of the main features of problems, combined with a remarkable ability for entering into the minutest of details. He read a number of papers before the Societies of which he was a member; and two of them—namely, "Gas Distribution and Modern Municipal Development" and "Thermal and Thermo-Dynamic Efficiency of Town Gas"—attracted considerable attention at the time of their publication. In addition to all his professional and technical work, Mr. Canning was one of the most prominent members of the Newport Town Council for a period of more than thirty years, having been elected in 1888. He was further elected a Harbour Commissioner in the year 1891, was raised to the Commission of the Peace for the Borough in 1892, and had been an Alderman since 1902. His special knowledge as an engineer was of immense value to the public bodies of which he was a member; and he always devoted himself unstintedly to the public service. He was a member of the Parliamentary Committee from the time he joined the Council, and for many years was its Chairman. Besides this, he was on the Water Works and Works Committees, and as a member of the Education Committee was Vice-Chairman of the Secondary Sub-Committee. He took great interest in the introduction of technical instruction into the borough, was largely responsible for the foundation of the local Technical Institute, and was a member of the Court of Governors of the University College of Wales.

The most distinguishing features of Mr. Canning's character were his devotion to duty, his integrity, his unfailing kindness and courtesy to all, and the strong and sincere religious convictions which formed the ruling principle of his life. He possessed remarkable intellectual power, and a capacity for intense concentration on a subject which enabled him very rapidly to master it and grasp the essential points. He was also a close student to the last, showing a complete mastery of all the modern developments in gas engineering; while on certain points—such as the application of electrical power and of the telpher to gas-works—he was among the pioneers. Mr. Canning was gifted with great versatility, and possessed a vast fund of information upon the most varied topics, which, together with a keen sense of humour, rendered his conversation most delightful. He was a gifted linguist, an excellent public speaker with a remarkable ease and power of expression, and was deeply read in both English and foreign literature. Reading was certainly his favourite recreation; and he derived therefrom a vast fund of information on history, art, science, archæology, and a host of other subjects which he was always most willing to dispense for the entertainment or instruction of others. Kindly, forbearing, and considerate, he was in all things eager to right a wrong; and his charming manner made him numerous friends.

His wife, who survives him, was a daughter of the late Mr. Walter Fiddes, of Bristol. Mr. Canning leaves three sons and two married daughters.

Society of British Gas Industries.—The annual general meeting of the Society will be held in the Connaught Rooms, on Wednesday, May 7. The programme of arrangements for the meeting will be announced later.

Gas-Works Coal Stocks.—Saturday's "Iron and Coal Trades Review" reports that the position of reserve stocks at gas concerns shows a further slight improvement. There are still 47 works with less than one week's supply in sight (including seven with less than three days'), and 93 works have less than two weeks' supply.

Yorkshire Junior Gas Association.—At a meeting in Halifax on Saturday afternoon, the members (after being welcomed by Mr. W. B. M'Lusky, the Gas Engineer) heard read and discussed a paper by Mr. F. Pykett, of Halifax, on the "Group or Duct System of Lighting." Unfortunately our report of the proceedings did not arrive until after this issue of the "Journal" had been made up for press; so that its publication has had to be held over until next week.

ELECTRICITY SUPPLY MEMORANDA.

Men of the electrical industry continue mightily puzzled over the Government proposals regarding electricity supply; and their reflections are deeply disturbing. They see the industry curbed and maimed by forms of hyper-control which it was never thought would be devised; and they see electricity being made to support cheap transport first, with the other and more profitable business coming in as a sort of appendix. The gas industry has long had its wheels clogged by Government control. The heavier the control, the worse has become the financial results of the industry; and the yearning for freedom has been great. The electricity industry is anticipating the Board of Trade Bill which is to create Electricity Commissioners, District Boards, consolidate electrical generation, and move towards super-power stations; and it finds itself hitched-on to the Ministry of Ways and Communications. But the industry must have been childishly optimistic if it ever thought that the Government would place in the hands of an electrically prejudiced body of Commissioners plenary powers in regard to electricity supply. It would be unlike Parliament to do anything of the kind. They have a great affection for safeguards. The Ministry of Ways and Communications is (it would seem) the fancy of the Government for exercising the necessary safeguards; and at the same time, the clever Government see that railroads, tramways, light railways, even perhaps canals, may prosper better by sucking out, at a low price, some of the life blood of the electricity industry. At any rate, this seems to be the trend of things. But perhaps matters will not turn-out quite so bad as they look.

The Nebulous Situation.

However, everybody who has spoken or written on the matter from the point of view of the electricity supply industry has shown, before knowing the whole position, strong antipathy to the placing of electricity in the arms of the Minister of Ways and Communications, to be cared for just as much as he thinks proper, and only to the extent that (so it is feared) will accord with his transport plans. The Incorporated Municipal Electrical Association has spoken, through their indefatigable Hon. Secretary (Mr. H. Faraday Proctor). He lately circularized among members of Parliament the view that the Association were gravely concerned over the proposal that the future supply of electricity should be taken out of the hands of the Board of Trade, and be placed under the control of the Ministry of Ways and Communications. It is feared that the electricity part of the proposal will be lost among the gigantic interests the Ministry will control. As the consumption of coal by railways is only 8 p.ct. of the total home consumption, whereas the consumption by factories is 31·8 p.ct., mines 10·6 p.ct., iron and steel industry 16·4 p.ct., and the domestic user 18·5 p.ct., the consumption of electricity by railways is never likely in its aggregate to exceed (say) 10 p.ct. of the national electricity supply. In view of the foregoing figures, it is difficult for the Association to see how the interests of the general manufacturing community, who are by far the largest users of electricity, can be adequately protected by the proposed Ministry of Ways and Communications, whose predominating interest will undoubtedly be railways. That the interests of industrial and domestic consumers should be reduced to a subordinate position is regarded as a serious menace to them. This is a view that is largely held inside the industry. Hence the appeal by the Association to members of Parliament to secure on second reading the elimination of the part of the Bill that simply places electricity in an ancillary position to transport.

Protests and Arguments Continued.

But what is keenly felt inside the industry does not apparently greatly affect what is felt inside the House. The appeal to the members of the House had very little effect. The second reading of the Ways and Communications Bill has taken place; and electricity was hardly mentioned in the debate. But it stands where it was in the Bill. Looked at from the standpoint of Sir E. Geddes, who is to be the Minister of Ways and Communications, the electricity industry is unduly alarmed. His proposals are really blessings in disguise. Electricity is one of the chief factors in transportation. It will enable transport to be developed in all the highways and byways of our industrial life. This in turn will contribute to the development of industry; and development of industry will mean the expansion of electricity. Why, it is all so very simple. Sir E. Geddes can see it; the men of the electricity industry cannot. He did not trouble himself much about it in moving the second reading of the Bill; but he would no doubt like the electricity industry to accept his brief assurances that his point of view must be the right one, and that of the electricity saturated brains of electrical experts altogether the wrong one. Look at the wonderful increase in the load factor, and the broadening out of the diversity factor. It is estimated conservatively that, when the electrification of the main lines which should be carried out primarily is accomplished, fully 20 p.ct. of the electricity of the country will be taken for traction. Railways, too, afford the best of avenues for the high-tension cables, from which could branch the cables penetrating into the industrial areas of the country. It is all so plain. Yet electrical

But Still Safely in the Bill.

men cannot see it, or they will not. They fear the proposals are going to rob the industry of some of its fecundity in the industrial and domestic regions. But Sir E. Geddes will have it that the contrary is the truth. What he knows of electricity has been gained on the North-East Coast, in connection with the railway electrification there. Perhaps some of the municipal suppliers of electricity do not like this intimacy of the new Minister of Ways and Communications with the electrical doings on the North-East Coast, with which Mr. Merz is so closely identified, and which doings had such a large testimonial on the ground of efficiency in the report of the Power Sub-Committee of the Coal Conservation Committee.

Eagerness for a Place in the Sun.

When the Government gets the electricity reorganizing powers into order, there will be something to do to co-ordinate the claims of all existing interests. We look with a great deal of sympathy upon the claims of some of the relatively small places with large aspirations to be considered suitable centres for electricity generation from which the mighty distribution arms can radiate. We rather fancy some of these places look at the matter from the revenue point of view. Having large generating stations in their midst as ratepayers, should be a desirable thing. It is well known that there have been many municipal electricity undertakings that have never been rated up to what they ought to have been; while gas undertakings have never felt the sensation of being well under-assessed. However, all the cities and towns that aspire to be convenient centres for electricity generation cannot hope to be successful. There will be much struggling, and much disappointment; but certain it is that the great change that is in embryo cannot develop with the rapidity that some folks anticipate.

The Reasons Behind the Scheme.

It is not, of course, suggested that Birmingham is a city with any such sordid consideration as becoming an electrical centre under the Government scheme for the purpose of reaping benefit from a well-assessed electricity generating station. But Birmingham is proceeding as though national schemes and the need for co-ordination of electricity generation were not before the country. The Corporation are applying to the Local Government Board to borrow £38,000 for the purchase of an extensive estate (comprising something like 1000 acres) for the construction of a new power station. This is doing things on the magnificent scale. The station is required immediately; and the Electricity Committee in this scheme are looking forward ten years. Ten years is a long while, unless what is proposed can be adopted as a unit in the national scheme. Eighteen years ago, when the Corporation took over the supply of electricity, the sale was about 3 million units; and now it is approximately 160 million units. But, of course, this includes the big inflation produced by the war. The Gas Department has also been driving with full force in meeting demand during the war. However, we get a good insight into the reasons lying behind this new proposal when we read: "It is true Birmingham will want this station for its own necessities in the not far distant future; but, in view of the coming change, there is additional reason to take care that Birmingham is not ousted from its natural position of leadership."

"GET A GOOD MANAGER, AND TRUST HIM."

By "Lumen."

With a refreshing mixture of truth and humour, an expert has been described as a man who does not get confused when under cross-examination. Experts would probably claim other qualifications; but they would certainly not deny that a cool head (apart from other things that it may or may not contain) is a *sine qua non*. There have been experts *and* experts before the Coal Commission; but in the humble judgment of the present writer, Sir Richard Redmayne, His Majesty's Chief Inspector of Mines, shone in the witness-chair with peculiar brilliance. He showed knowledge of facts germane to the issue, broadmindedness, practical wisdom, the saving grace of humour, and, judging from his replies, he would have fully satisfied our worthy humorist in the matter of keeping cool under cross-examination. Among a score of other questions, Sir Richard was asked about the possibility of good management of mines by a committee under nationalization. "Get a good manager," he replied, "and trust him." Seven words only, and little words, too. But, oh, how charged, how weighted with wisdom! They contain the secret of successful management; and they deserve to be emblazoned in letters of gold on the walls of board-rooms, council chambers, and other places where business men do congregate. Perhaps the motto would be all the better if a few more short words were added—"Get a good manager, trust him, and pay him well."

How many a manager—the word is used in a general and inclusive sense—has had the heart taken out of him, his initiative sapped, his mental energy reduced, by the carping, uninformed criticism of men, dressed in a little brief authority, whose poor minds are obsessed with the idea that a servant must be kept in his proper place; and so they pursue a policy of interference, opposition, and even innuendo. The victim bears this treatment for a time, keeping his courage and temper manfully; but slowly the virus eats into his soul, and a mood of despondency sets in. "What's the good of worrying? What's the good of trying? What will it all matter twenty years hence?" So he pursues the line of least resistance, sleeps soundly o' nights, pays an ever-increasing attention to his own private affairs (matters which he had previously somewhat neglected), and obtains a new appointment in the hope that the "powers that be" will have the sense to appreciate energy and initiative—in other words, trust him.

Private employers in a large way of business are usually shrewd enough to value a good manager, and to treat him in such a way as to secure his hearty co-operation, and the maximum output of brain energy; for they know how great is the driving-power of a competent and energetic man, and how, even in spite of obstacles and difficulties, he will secure good results. But there are many directorates and committees which contain men who are not endowed with this prescience, but who are apt to look upon a resourceful and vital manager as "pushful" and "domineering," and who consider it to be their duty to oppose, on principle, any proposals he may bring before them. Now, the strong probability is that the manager's qualifications for "running the business" are superior to those of anybody else connected with the concern. On his applying for the position he occupies, he doubtless had to produce evidence of fitness and unimpeachable credentials, and, more likely than not, he was selected out of a large number candidates. What proof of fitness did the director or committee-man produce before he was appointed? Could he have passed an elementary examination as to the business he aspired to direct or control? There has been an improvement in the competence of directors, &c., during the past decade or so, because, in face of increasing competition, home and foreign, it has become more and more recognized that business undertakings require for their successful prosecution some training in or, at all events, some knowledge of, them. But even to-day, the holding of a few hundreds of a company's capital and the possession of urbane and ingratiating manners are often considered sufficient qualifications for a directorship. Is there any wonder that Official Receivers are kept busy? The ignorance of some directors may add to the unconscious humour of a dull world, and cause merriment among subordinate officials; but these things, however excellent in themselves, are scarcely the stuff from which thriving industries are built. There is a story told that a company in London, which controls a large area of farms in the Cape Province, dissatisfied with the excuse given that, owing to the lambing season shearing could not be proceeded with, cabled to the Cape manager: "Stop lambing; start shearing."

The more incompetent the board or committee the greater is the need for an efficient manager. Yet the atmosphere which the former creates is usually just the one that a good man cannot breathe; for good men (to change the metaphor) cannot suffer fools gladly. And thus—incompetence breeding incompetence—it often comes about that the failure of a business follows hard on the heels of the efficient manager who has been driven away.

"Get a good manager, trust him, pay him well, and praise him." Yes, these further words might be added with advantage; for even a good manager is human, and the best that is in him is more likely to be called forth by judicious appreciation than by fault-finding. If he knows he is held in high esteem, and that his judgment and advice are valued, he will endeavour to live-up to his reputation, and no trouble will be spared on his part to merit the confidence and trust reposed in him. "Praise judiciously bestowed," says an American writer, shrewdly if a little heartlessly, "is money invested."

Masonic—Murdoch Lodge, No. 3480.

The annual festival of this Lodge was held last Thursday at the Imperial Hotel, Birmingham, when Bro. W. J. Rendell Baker was installed Master, in succession to W. Bro. Luke B. Taylor. The following is a list of the officers of the lodge for the ensuing year:

W. Bro. W. J. Rendell Baker	W.M.
W. Bro. Luke B. Taylor, P.M. 347	I.P.M.
Bro. H. J. Woodfine	S.W.
Bro. Frank Jervis	J.W.
W. Bro. R. J. Milbourne, P.M. 1896	Chaplain
W. Bro. Fred Vale, P.M. 560, P.P.A.G.Sec. Worcs.	Treasurer
Bro. W. M. Valon	Secretary
W. Bro. Vincent Hughes, P.M. 2582, Prov. G.Stwd.	Charity Steward
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The inaugural dinner of the Chemical Engineering Group of the Society of Chemical Industry took place last Friday, in the Abercorn Rooms, Liverpool Street, E.C. Prof. Henry Louis (the President of the Society) was in the chair.

CARBONIZING PROCESSES AND COAL UTILIZATION AND CONSERVATION.

Prof. W. A. Bone's Second Cantor Lecture.

The second of the Cantor Lectures by Prof. W. A. Bone, D.Sc., Ph.D., F.R.S., was delivered at the Royal Society of Arts yesterday week; and on this occasion he treated of the carbonization of coal in relation to the heating problem. The following is a fairly full report of the lecture.

National Policy.

Commencing the lecture, Prof. Bone said: Although, as we saw last week, coal is the world's most important fuel—and the principal source of its artificial heat, light, and power—it is far too valuable a material to be burnt indiscriminately by people ignorant of its true worth, as in the bad old days that are behind us. When suitably handled by the chemist, it is capable of yielding bye-products—such, for instance, as naphthenes, benzols, tars, ammonia, &c.—whose values to mankind far exceed their mere heat-producing powers when burnt in the ordinary way in our furnaces and fireplaces. Hence the chemists' objection to the burning of raw coal before it has been treated for the extraction of such bye-products. My object on this occasion is to discuss not so much details of technical practice, but policy, and particularly national policy. A true national policy of coal economy will not concern itself so much with prolonging the life of our coalfields as with getting the utmost "economic result" out of the coal we actually use. And by "economic result" I mean the maximum return in value for a given expenditure of capital and labour on the raw material operated upon.

Thermal Efficiency v. Total Result.

If you will just think over that definition for a few minutes, you will see that I do not use the term "thermal efficiency." The thermal or power result is one of the many results that you can get out of coal; but there are other economic results and other factors which enter into the problem besides that of thermal efficiency. I think, in discussing this question, we want to get out of the way of talking only about thermal efficiency. It is a very important factor—in some cases the predominantly important factor. But it is not always the deciding factor. For instance, I have sometimes had to consider schemes for the production of power from coal or waste gases that have been thermally more efficient, but commercially less efficient, than alternative schemes that have finally been selected; and the ground of decision there has not been final thermal efficiency, but total result. This is not always sufficiently understood by so-called scientific people—in fact, commercial people often take a more scientific view of these questions than the scientific man. They look at more factors than the scientific man. Therefore I want you to understand that the term "economic result" means the maximum return, for a given expenditure of capital and labour, from the raw material operated upon.

Coal Should be Used to the Best Advantage.

Inasmuch as immense quantities of coal must necessarily be consumed every day to maintain our social and industrial system, and also that the purposes for which large quantities of coal are consumed are various—for instance, to generate power, to smelt iron, to make steel and other special alloys, to produce public supplies of gas, to warm our houses and cook our food—it behoves the nation to ensure that our available reserves of coal are used in ways that are calculated to fulfil such purposes to the best advantage, and that no individual or section of the commuity is allowed to use them wastefully. Now, paradoxical though it may seem, past experience has abundantly proved the truth of Jevons's dictum, that the more economy is practised in the use of coal, the more will its consumption increase, because, as he rightly said: "Economy multiplies the value and efficiency of our chief material; it indefinitely increases our wealth and means of subsistence; and it leads to an extension of our population, work, and commerce, which is gratifying in the present, but must lead to an earlier end." Hence it follows that we must not expect to prolong the duration of our national coal reserves by using them more scientifically; we shall probably only hasten the end by so doing. The true object of national fuel economy should be to ensure that our coal is used to the best and the fullest advantage by every class of consumer. For true economy lies not so much in using sparingly as in using well.

Now before applying all this to the subject I am going to consider to-day, I would like to direct your attention to the statistics on the screen:

The Principal Uses of Coal in the United Kingdom in 1913.

	Million Tons.		Per Cent. Approx.
1. Mines and factories	80	Power	40
2. Iron and steel and metallurgical industries	32	Iron and steel works and Carbonization	27
3. Manufacture of bricks, ceramics, glass, and chemicals	6	Domestic	20
4. Railways and coasting steamers	17	Transport	10
5. Gas-works	19		
6. Domestic purposes	35		
Total	189		

It is difficult to state exactly what is our coal consumption in a given year for all the various purposes; but it may be said with a tolerable degree of accuracy that, before the war, the coal annually consumed in our mines and factories, chiefly for power purposes, amounted to about 80 million tons; in the iron and steel and other metallurgical industries, about 32 million tons; for the manufacture of bricks, ceramics, glass, and chemicals about 6 million tons; for railways and coasting steamers, about 17 million tons; for gas-works, about 19 million tons; and for domestic purposes, about 35 million tons a year. This is important. You will find for the purposes of power, we consumed about 40 p.ct. of the total coal used in the kingdom. In connection with iron and steel works and carbonization (including gas-works and coke-ovens, which I bracket with iron and steel for a reason which will become apparent later), we use about 27 p.ct.; for domestic purposes, about 20 p.ct.; and for transport (including railways and coasting steamers), about 10 p.ct.—leaving only a small percentage for other purposes. If we take power, metallurgical, and carbonization (which are closely allied), and domestic uses, you have accounted for nearly 87 p.ct. of the whole of the coal consumption of the kingdom. Upon these three classes of uses, I am going to concentrate in the remainder of these lectures.

Classification and Uses of Coals.

I want to remind you that, when we use the word "coal," we are employing a term which is very comprehensive. It is really a generic term; and it comprises a great many different types or classes of raw materials—all of which have the same kind of origin, but each of which has its individual special qualities and uses. The table [thrown on a screen] shows the various kinds of coal which are available:

Types:	Anthracites.	Anthracitic and Semi-Bituminous.	Bituminous.	Lignites.
Uses:	Central heating Stoves Malting kilns	Smokeless "steam" coals.	Coking. Gas-making. Furnace. Purposes.	Bye-product recovery probably will pay in many cases.
Remarks:	Bye-product recovery in general not economical.		Bye-product recovery always very economical.	

Graded: According to (1) size, and (2) ash-content.

Beginning with the lignites—the brown coals—they do not occur to any great extent in this kingdom. The bituminous class of coal constitutes the most important part of the world's reserves. Then there are the semi-bituminous, which are intermediate between the bituminous and anthracitic. Each one of these genera, particularly the bituminous, is subdivisible into classes. If you take the anthracite coals, in which the carbon is most concentrated, these are used for central-heating stoves and melting-kilns. The anthracitic (which are non-caking coals) are used for steam-raising; as also are the semi-bituminous. These correspond to the South Wales Admiralty steam-coals. The first class of bituminous coals is that used for the manufacture of hard coke. But gradually the coking properties fall off, until you get to the class of gas-making coals from which the coke is weaker; and then, as you go up, you get coals which are non-coking. Finally you come into the lignites which are all devoid of coking properties. There is a regular order which the classes follow; and their uses also correspond to such order. You go from steam-raising, gradually to coking; and from coking out through gas-making to furnace coals; and then pass into the inferior grades of lignites. Then besides the classification in this way, we have a grading inside these classes. In some cases, the coal as won from a mine is mixed with a considerable amount of incombustible matter—shale and so forth. Some of this coal is of inferior grade. I shall have to refer in my next lecture to some of these inferior grades, among the bituminous and the semi-bituminous classes of coals. A low-grade coal, although it may have caking properties, may not be suitable for coke making; or, similarly, a very low-grade coal, although the coal substance of it may give a good yield of gas, may not be suitable for gas making, though no doubt many gas-works have had, during the last year or year-and-a-half, to deal with much unsatisfactory material.

There is also another point that I must refer to. You may get bituminous coals which are so soft that, when they are removed from the seam, they have very little marketable value, although very good coals for distillation purposes. These coals, if used at all profitably, must be consumed in the neighbourhood of the colliery. Otherwise, their value at any distance is small, inasmuch as they will not stand transport. So we have the problem to meet of dealing with coals which, for some purposes, may be very suitable commercially, but are of too soft or friable a nature to stand long transport. Therefore, when considering the coal economy of this country, there are a great many factors to take into consideration in laying-out a national policy.

Let me say this: Fortunately, our British available coal reserves though quantitatively small, are for the most part qualitatively of the best, and moreover are well situated both in regard to our ports and to our iron ore deposits. Also they are unusually well-varied in their qualities. Thus, in Durham we have perhaps

the finest "coking" coal seams in the world; in Yorkshire and Derbyshire, some of the best "gas-coals;" in South Staffordshire, good "furnace coals;" while the South Wales semi-bituminous steam-coals are famous throughout the world. It would seem as though Providence has put down in this little island of ours a great variety of materials—not a very great quantity—and that we are intended as a race to discover, invent, and pioneer things. This is one reason why this country has been so favourably situated for pioneering new industries. We have within our borders a great variety of raw material, and this applies particularly to coal.

Low-Grade Fuels and a Question of Future Policy.

Now what I want to emphasize is this, that, when you are considering your future policy, you must remember (as I said last week) that the export trade of the country is of paramount importance. Thus your policy in regard to power production would be to utilize, as far as possible, the lower grades of coal, and to send the better grades of "steam coals" out of the country.

The policy of electric power supply, which has been so extensively criticized, has been very much misunderstood. Some of the critics have quite misinterpreted what is intended; and I shall try to show next week that the utilization of low-grade fuels for power purposes is likely to become a very important economic question, and a deciding factor in choosing the schemes.

The Percentage that should be Carbonized.

Coal is so valuable a material that we want as far as possible to avoid burning it as raw material; but in our present state of industrial development, it is difficult to realize this ideal. We ought always to aim at the recovery of valuable bye-products. Certainly, the world's industrial development is already so far advanced, that we can say that all coals intended for use in the smelting of iron and steel and in gas making, and I hope in the near future also for domestic consumption, should be carbonized in some way or other before use.

Uses of Coal in which Complete Bye-Product Recovery is, or should be, Possible.

Coking (iron and steel works) Gas making (gas-works) Domestic		Say, 45 p.c. of the nation's total consumption.
In 1913 we carbonized	10 p.c. in gas-works 7 „ in coking plants	17 p.c.

If you take the consumption of coal in the United Kingdom for the three purposes named, you will find that it is 45 p.c. of the whole. So we ought now, or in the near future, to be able to carbonize some 45 p.c. of our total consumption. I find that in 1913, we carbonized approximately 10 p.c. of the coal in gas-works, and about 7 p.c. in bye-product coking plant, or a total of 17 p.c. We might—and I hope we shall at an early period—have carbonized about 25 p.c. Certainly we should do so in view of the possibility of carbonizing part of our domestic supply.

A certain amount of bye-product recovery ought also to be possible in regard to the coal consumed for power purposes. This recovery may be complete or partial; and it should be our object in investigation or research to try to expand the possibilities of bye-product recovery in regard to certain classes of our coal that are used for power production. I do not say we shall find it possible or desirable to carbonize, either partially or completely, all the coal required for power production. I am not putting forward an ideal like that. We are not yet far enough developed; but at present we ought to be devoting ourselves to investigating the possibilities.

High and Low Temperature Carbonization.

I am now going to consider the coal used for domestic and metallurgical purposes. We are familiar with the carbonizing of coal at high temperature in gas-works; it was not until comparatively recent times that it was seriously proposed to deal with coal at lower temperatures.

Comparison between Low and High Temperature Carbonization.

Low Temperature, 500° to 600° C.

Semi-Coke.	Motor Spirit.	Fuel Oils.	Rich Gas.
70 to 80	6 to 10		2500 to 4000 c.ft. per ton.

Ammonia as sulphate, 6 to 10 lbs. per ton.

High Temperature, 900° to 1100° C.

Hard Coke.	Benzols.	Benzolic Tars.	Gas = 12,000 c.ft. per ton.

Let us see what we are likely to get out of coal carbonized at low temperature. I mean by "low" a temperature between 500° and 600° C. If we carbonize at this temperature, we must select a coal that will give a residue that is either naturally coherent or which can easily be briquetted under pressure. We shall obtain from it, as a rule, about 70 to 80 p.c. of its weight of what I call "semi-coke." This "semi-coke," if it could be prepared in a condition that would stand transport and distribution, would be an excellent fuel for burning in household fireplaces. Then there is a comparatively large amount of tars or liquid products that would condense. These products would consist chiefly of what the chemists call the naphthene series of hydrocarbons. There is here one very important difference between this and high temperature working. You have all heard that the benzols and toluols (the benzol hydrocarbons) have played an extraordinarily important part in the war. We derive from them our high explosives, which we have used so effectively in the war. They are also the basis of coal tar dyes; and we can prepare from them a number of synthetic drugs, disinfectants, &c. These valuable hydrocarbons are not found in the tars produced at low temperatures. According to investigations made in mine and other laboratories, low-temperature tars are mainly composed of hydro-benzols. This is what you get from low-temperature carbonization; and the amount is about 6 to 10 p.c. of the weight of the coal, according to the kind of coal. Then there is a small amount of fairly rich gas—varying with English coals from 2500 to 4000 c.ft., or more in the neighbourhood of 3000 c.ft. than any other figure. This gas is very rich in paraffin hydrocarbons—methane, ethane, &c., but very little hydrogen. Speaking from memory, analysis shows that it only amounts to about 15 p.c. of the whole gas. One other important point I must not forget. At such low temperatures, you do not get much ammonia. It would not amount, if converted into sulphate of ammonia, to more than 6 to 10 lbs.—generally from 6 to 8 lbs.—per ton of coal.

Commercial Prospects of Low-Temperature Carbonization

The chief difficulty about the wider adoption of low-temperature distillation is a commercial one. The process would be good if it would give a good "semi-coke" which will stand transport. Another difficulty is that the commercial value of the tars is not great. The naphthenes could be used as motor spirit and fuel oil. But they cannot be made the basis of coal tar dyes, unless they are cracked; and then the coal might just as well be distilled at high temperature straight away. It is quite possible technically to carry out the low-temperature process; but the commercial prospects have not so far been very encouraging. Of course, changing circumstances may produce change in the prospects. I for one hope to see the day when low-temperature carbonization will be, not more technically perfect than now, but the prospects of it will be better. That day may arrive more quickly than some people think.

High-Temperature Carbonization and Changes in the Situation.

Now we come to carbonization at high temperatures, by which I mean carbonization at temperatures from (say) 900° to 1100° C. We get here, if a suitable coking coal is chosen, a hard coke, and especially if we select a coal from among the hard coking series. Then we also get benzene, toluene, benzenoid and phenolic tars, *plus* a considerable amount of ammonia. The resulting "coal gas" also contains a number of constituents, the nature of which we shall see. High-temperature carbonization has been carried out in this country on a large scale for about a century, and is so well-established an industry that its prospects do not require talking about, because they have already been realized. Now the question arises: How, in the public interest, should this process of high-temperature carbonization be carried out in future, and what should be aimed at in regard to public gas supplies? I propose to discuss one or two changes that may possibly come over the carbonizing situation. We are at present in a state of transition or flux. A great many competent people are thinking about carbonization problems, and what our future policy should be. They do not all agree; and I may have to refer to proposals with which I do not personally agree. But I think it right to give you as far as possible not only an unbiassed statement, but a reasoned statement of the *pros* and *cons* of the various suggestions that have been made.

Here Professor Bone introduced some slides showing typical coking plants. As to results, he said: We get, with the best types of coking coals, round about 1 p.c. in the form of benzol and toluol in the finished condition, from 2·5 to 5 p.c. of the weight of the coal in tars, and about 1¼ to 1½ p.c. of sulphate of ammonia, or 30 lbs. per ton. The results of an analysis of coke-oven gas show: Hydrogen, nearly 50 p.c.; methane, 30 p.c.; carbonic oxide, 7 p.c.; heavy hydrocarbons (in this case unusually high), 3·8 p.c., instead of about 2·5; and nitrogen, 7 p.c. The calorific value of this gas (not debenzolized) is 584 B.Th.U. gross, and 521 B.Th.U. net. This shows the kind of gas that is obtainable from coal by carbonizing at temperatures of about 1000° to 1100° C.

Heat-Balance of Typical Gas-Works Carbonization in Vertical Retorts.

One Ton of Coal = 30,000,000 B.Th.U. = 100

Also		B.Th.U.	
30 lbs. amm. SO_4 at £12 profit per ton = 3s.	11·75 cwt. of coke	= 18,000,000	= 60
	13,000 c.ft. of gas	= 7,200,000	= 23
	100 lbs. of tar	= 1,700,000	= 6
		26,900,000	= 89

Composition of the Gas.

CO_2	CO	C_nH_m	CH_4	H_2	N_2
2·5 ..	10·7 ..	3·4 ..	27·0 ..	52 3 ..	4·1 p.c.

Calorific value { Gross = 550 / Net = 494 } B.Th.U. per cubic foot at 15° C., 760 mm.

Now let us look at the matter from the point of view of a heat proposition. If you carbonize coal on a gas-works in vertical retorts, and take the potential heat value of the coal as 100, then in the coke remaining over (after deducting that required for heating the retorts), about 60 p.c. of the heat value of the coal

will be obtained; in gas, about 23 p.ct.; and in tar about 6 p.ct. —a total of 89 p.ct. This is therefore, thermally, a very efficient process. The composition of the gas will be something as shown in the table; and the calorific value in this particular case was about 550 B.Th.U. gross, and 494 B.Th.U. net. This is a sample result obtained from ordinary high-temperature carbonization.

Steaming Vertical Retort Charges.

Investigations have been made with the object of trying the influence of introducing steam under pressure at the bottom of the vertical retort during carbonization. The idea is to utilize the heat in the coke at the highest temperature to generate water gas; and this gas passing upward materially assists in the distribution of heat in the retorts. These steaming experiments have been highly successful. It is probable that the efficiency of carbonization will thereby be considerably increased, and that the practice of steaming the charges in vertical retorts will become common. I may quote the result from one series of experiments.

Steaming of the Charge.

[Steam introduced at 40 lbs. pressure through a ¼-in. nozzle.]

Result: 16,600 c.ft. of gas per ton (instead of 14,000 c.ft. without steam).

	CO_2	CO	C_nH_m	CH_4	H_2	N_2
Composition:	3·7 ..	17·1 ..	2·2 ..	20 ..	57·2 ..	5·0

B.Th.U. in gas per ton: 8,386,000, or (say) 28·0 p.ct. of the heat value of the coal.

The coal used normally gave 14,000 c.ft. of gas per ton. Steam was introduced at 40 lbs. pressure through a ⅛ in. nozzle; and the result was that the production went up to 16,600 c.ft.—or an increase of 2600 c.ft.—containing some 20 p.ct. of methane, 57 p.ct. of hydrogen, and 17 p.ct. of carbonic oxide. In the ordinary carbonization process, the potential heat in the gas is about 23 p.ct. of that of the coal. By steaming, this was increased to 28 p.ct., at the sacrifice of some of the coke. If it is desired to get more heat units into the gas, then this policy of steaming retorts is to be commended.

Effect of Gasifying the Coke.

Then there is another possibility. In carbonizing coal, both gas and coke are made. The coke can be gasified entirely in a water-gas generator. Many people believe that, instead of gas companies selling coke, it would be better for them to gasify the whole of it, and supply a mixture of blue water gas and coal gas. In America, this has been done for many years; and the usual custom is to mix a straight coal gas with carburetted water gas. When I was in New York, I believe the gas I had to use in my lectures had a calorific power of something like 750 B.Th.U. I do not suppose it will be suggested here that we should mix with our coal gas a carburetted water gas; but I think the suggestion is we should supply a mixture of blue water gas and coal gas. Let us see what sort of result we should then get. I have calculated out these figures in order to give you some idea.

Composition of the Mixed Gas.

CO_2	CO	H_2	CH_4	CnHm	N_2
3·5 ..	35·0 ..	50·0 ..	7·0 ..	1·0 ..	3·5

Calorific values per c.ft. at 15° C. and 760 mm. { 370 gross. 320 net.

B.Th.U. in gas yielded per ton of coal { 18,500,000 gross = 57·0 p.ct. 16,000,000 net = 52·0 p.ct.

Supposing we get 50,000 c.ft. of gas per ton of coal, containing a mixture of 13,000 c.ft. of coal gas, and about 37,000 c.ft. of blue water gas. You may obtain a little more theoretically; but there will be wastages. However, 50,000 c.ft. may be taken as a good working result. The composition of the gas would be 7 p.ct. of methane, 50 p.ct. of hydrogen, 50 p.ct. of carbonic oxide; and its calorific value, 370 B.Th.U. gross, and 320 B.Th.U. net. Taking the calorific value of the coal and of the gas, you find you have in the gas 57 p.ct. gross of the heat value of the coal—a net calorific value of 52 p.ct. Completely gasifying the coal in this way, we might possibly get as high as 60 p.ct. of the heat value of the coal with the gas. Some people think this would be a good plan.

Selling Gas on the Gross Value and Testing Efficiencies on the Net.

There is one point the public should know. When the gas industry is selling gas, it does so on the gross calorific value; but when it advertises the efficiency of gas-burning appliances, it uses the net value. If the net is used in calculating the efficiency of a gas-fire, then gas should be sold on the net value. Conversely, if gas is sold on the gross value, then the efficiency of the appliances ought to be calculated on the gross. Gas companies cannot have it both ways. I always like to take the net value when dealing with the efficiencies of appliances or the calorific value of gas.

Charges Based on Calorific Power—Is One B.Th.U. Always as Good as Another?

Now I am going to enter upon a very thorny question. There is a great deal of discussion and some agitation in the gas industry about the future standard of gas that shall be supplied to the public. A great many suggestions have been made. It has been proposed that the consumers' charges should no longer be based on so many cubic feet of gas, the quality of which may vary enormously. You may buy in one place 1000 c.ft. of gas which may be worth one-and-a-third times the heating value of 1000 c.ft. of gas supplied in a town (say) some five or ten miles away. It is not satisfactory that a consumer should be charged solely on a volume basis. The very interesting proposal has been made public by the Chairman of the South Metropolitan Gas Company (Mr. Charles Carpenter, D.Sc.), who is a very eminent scientific gas engineer, that gas should be sold and charged for on its calorific basis, and that consumers should pay so much for every 100,000 B.Th.U's. Let us see how this is going to work out. Admittedly, it has certain advantages. Undoubtedly, on the face of it, it is fair. The consumer will know what he is buying. He will buy heat units or energy; and the company supplying him will not be able to charge him for a lot of inert gases. This is all to the good. It is not right that a gas company should supply large quantities of nitrogen to their consumers; but under the system of payment on a calorific basis, they will not be able to charge for it. Possibly then we shall have less "incombustibles" passing through the gas-mains into our houses than at present. From this point of view, I like the proposal.

There are, however, certain objections—I will not say fatal objections. The proposal involves another proposition—namely, that the value of gas can be referred to a purely thermal basis, irrespective of the concentration of the energy; and it brings to mind an expression coined elsewhere in the gas industry, that one British thermal unit is as good as another. It is not so. With a person who is unfamiliar with the chemistry of combustion, the proposition may find favour. But no chemist, when viewing the matter from an independent standpoint in the light of present-day knowledge, is likely to agree. The assertion wants to be looked at; and I am going to put before you certain considerations. What do we burn when we realize these thermal units? We do not burn gas simply when we develop flame. Wherever we develop flame, we are burning an explosive mixture of gas and air. We have to consider the properties not of the gas simply, but of the mixture. We cannot get away from using a mixture. The consumer need only buy gas; the air is supplied to him for nothing. He can take it in without any effort. It is certainly not a matter of indifference to the consumer as to the concentration of the heat units in the gas supplied to him. If I am feeding a large furnace, it is not a matter of indifference to me whether I get 600 or only 300 B.Th.U. in a cubic foot of gas. Concentration is not a matter of indifference. In the second place, it would probably not be good policy from the public point of view to send through the mains of our cities (which mains cost a great deal of capital) a gas of low-grade value. If the industry were to attempt it, and supposing that by some extraordinary circumstance it were profitable to do so, I think the public might say that they do not want a lot of useless inert material sent to them. Obviously, there is some point at which it will become good policy to draw the line.

Let us look at the questions of safety and convenience. Gas is not used by scientific people only. It is used by a great variety of people, from those who live in kitchens upwards. And when people have to employ an explosive mixture, it is necessary that it should be as nearly fool-proof as possible. I am going to compare the three chief constituents of coal gas—methane, hydrogen, and carbonic oxide. Comparing first methane and hydrogen. In

(a) Methane and Hydrogen.

	CH_4.	H_2.
Calorific values per c.ft.	1064 ..	343
	951 ..	287
Range of explosibility with air	5·5 to 14·0 ..	15 to 65
Relative radiation from flame	4·4 ..	1

(b) Hydrogen and Carbon Monoxide.

	H_2.	CO.
Calorific values	343 ..	—
	287 ..	341
Relative radiation from flame	1 ..	2·4

a cubic foot of methane, there is practically three times as much potential heat as in a cubic foot of hydrogen. In the second place, the difference in the ranges of explosibility of methane-air and hydrogen-air mixtures, respectively, is very large. Methane has a low rate of explosibility with air—only between 5 and 14 p.ct. Further, in small pipes (2 in. to 3 in. pipes) the rate of propagation of flame through the most explosive mixture of methane and air is comparatively slow—not more than about 100 centimetres per second for all pipes up to 3 in. diameter.

Let us look at the hydrogen and air mixtures. Their explosive range is between 15 and 65—a very wide range of explosibility; and the rate of propagation of flame through the most explosive mixture is 500 centimetres per second in a pipe of 1 in. diameter. If you are going to say it is a matter of indifference whether or not the consumer has a gas of wide range of explosibility, I must disagree. I would much rather, if I am going to use gas, have a certain minimum quantity of methane in it.

Compare again hydrogen and carbonic oxide. These are two interesting gases, because their calorific value per cubic foot is about the same. Therefore, you may say it is immaterial whether we are supplying hydrogen or carbonic oxide. Wait until you have an escape, and it may make the difference between this world and the next for you whether the gas is hydrogen or carbonic oxide. If you are using this gas for certain heating purposes in furnaces for (say) steel melting, then the carbonic oxide is a more efficient gas than hydrogen—the reason being that the

amount of radiation from a flame of a given size from carbonic oxide is 2·4 times that from a hydrogen flame. And for anyone who understands combustion this means a great deal.

Investigation by a Competent Tribunal.

Now I put it to those gentlemen who are propounding these problems for us that it is not true to say it is a matter of indifference as to how the potential heat units are present in a gas. I have here indicated one or two considerations that ought to be taken account of; and although I have put before you perhaps an extreme case (for I do not suppose anybody wants to supply you with either pure carbonic oxide or methane), I think I have shown you enough to convince you it is a question for careful consideration. I do not say the proposal made by Mr. Carpenter should be turned down. Perhaps the advantages may be on the whole on its side. But charging for gas simply on the calorific basis is a proposition which should not be accepted without very careful inquiry and consideration of other factors concerned in the general utility of a heating gas. I am a little afraid that very possibly the plan emanating as it does from so eminent a source as Mr. Carpenter may be accepted, because it looks so fair; and admittedly it is a fairer one than that at present used. I feel sure that Mr. Carpenter has put forward the proposal because he believes its adoption would be in the public interest, and it is one that must, and undoubtedly will, receive great attention. But, all the same, it ought to be clearly and critically examined from every point of view before any final decision is made.

In conclusion, I desire to express the opinion that when a question such as this is to be decided, it should be by some authority specially set up for the purpose, and representative of the best scientific opinion. I do not think this is a matter that should be left to an *ex parte* committee appointed by the gas industry itself. There are a great many other people entitled to say something on the subject. There are many people who have done much work on the subject of explosive mixtures whose voices ought to be heard. Under existing arrangements, it is probable they will not be heard. But it is eminently a subject on which the best and most experienced opinion should be sought. While I do not think it should be left to any committee appointed by the industry itself, neither do I think it should be referred to any bureaucratic committee. It should be referred to a committee appointed *ad hoc* for the purpose, and armed with parliamentary authority. I am much afraid of such questions being decided in a hurry. We may be impelled on to a wrong course. The industry itself might require some enlightenment and guidance from some persons whom it does not ordinarily consult. In the public interest the consumer ought in this question to have a very strong, if not a predominant, voice. After all, it is for the benefit of the people of the country that any industry such as the gas industry is given the power it possesses. If the question is to be rightly decided from the point of view of national policy, I am convinced that it ought first of all to be investigated by an independent *ad hoc* committee, composed of the ablest and the most experienced scientific men and technologists who have specially studied gaseous combustion and industrial heating operations. Undue haste, and especially any attempt to "rush" a decision, is much to be deprecated; and I do not know of any existing body sufficiently representative of all the interests concerned to whom the question could be referred.

Now I think I must leave the matter at this stage. I had hoped to have got a little further. In the final lecture I propose to deal briefly with future policy in regard to power, and to explain some of the important points in connection with the Coal Conservation Sub-Committee's report.

SIXTY YEARS AGO.

[From the "Journal" for March, 1859.]

Gas Agitation in the Metropolis.—From the headquarters of gas agitation in the Metropolis, there comes the strange announcement that the representative Council of Marylebone have agreed to petition Parliament against the Bill of their own creation for the establishment of a new gas company in the borough. It seems that they are afraid of their own child while it is yet in embryo, and think it needful to apply for protection against its possible misdeeds. As the new company meets with opposition from its own parents, it will have but a poor chance of ever being in a condition to cause the anxious alarm against which the far-seeing sages of Marylebone think it necessary to provide. The gas movement has also spread to the fairy regions of the Crystal Palace; but it seems somewhat doubtful whether it has a serious object, or is merely a sportive display of activity appropriate to fairyland. It may be that the movement is got up merely to burlesque the more sombre folly of the gas agitators of the Metropolis; for the prominent grievance alleged against the Crystal Palace Company is that they give too much pressure, so as to occasion a greater consumption of gas—the public lights inclusive. Truly the gas agitators are very difficult to please; for while in London one of their chief complaints against the companies is insufficient pressure, at Sydenham an accusation of fraud is raised because the pressure is too great.

Lighting of Crawley with Gas.—The little town of Crawley, in Sussex, was lighted with gas for the first time on the 14th ult. The works have been erected under the direction of Mr. Sheppard, of Horsham, by Mr. Lynch White, of Upper Ground Street, London, who has been highly complimented upon the manner in which he has performed his contract. The event was celebrated by a dinner given at the Station Hotel, at which forty or fifty highly respectable inhabitants were present.

Combustion Products of Coal Gas.—We imagined that the oil-of-vitriol controversy had been satisfactorily disposed of, and that the notion that the combustion of purified coal gas generates sulphuric acid had been consigned for ever to the same limbo of exploded fallacies as the notion that the sun goes round the earth, or that the latter is an immovable extended plane. It seems, however, that certain absurdities possess inextinguishable vitality, and after they had been dead and buried and forgotten, or remembered only as the wild fantasies of ignorance, they are from time to time resuscitated with solemm gravity, and with as much pretension to be veritable truths as if they had not been years before indisputably proved to be based on error and altogether fabulous. A remarkable instance of this kind recently occurred at a meeting of the Society of Arts, at which a communication was read from Dr. Henry Letheby, again asserting—with an amount of assurance indicating complete obliviousness of the exposure of his ignorance of the subject four years ago—that the destruction of books in a library is attributable to the generation of sulphuric acid by the burning of gas.

SULPHATE OF AMMONIA PLANT IN GERMANY.

A recent issue of the "Journal of the Society of Chemical Industry" contains two abstracts of communications on this subject by Herr E. Wolff to the "Journal für Gasbeleuchtung," Vol. LXI., pp. 577, 601.

The first says: The impossibility of obtaining suitable material for the renewal of worn-out parts of the plant, and the necessity of using sulphuric acid containing nitric acid, are among the war conditions which have made it difficult to maintain efficiency. At the Mannheim Municipal Gas-Works, the indirect process is used. The saturator consists of a closed iron vessel, lined with lead and acid-proof stone, and is joined by a connecting pipe of "chemical" lead to a smaller vessel (the supersaturator), also lead-lined. A steam ejector of phosphor-bronze removes the liquor from the saturator; carrying it by means of a blow-over pipe through a receiving vessel and a sloping trough to a salt-box, provided with a sluice-valve, by means of which the mother-liquor is sent through a return pipe to the supersaturator—the salt being delivered through the sluice-valve to a hydro-extractor. The liquor from the extractor is also diverted to the supersaturator. Phosphor-bronze being no longer available, when the corrosive action of the sulphuric acid produces a hole in the blow-over pipe, the damaged part of the pipe is cut out, and the end of one of the sound parts is widened and forced over the end of the other part until fast, or the two parts are joined by a piece of lead piping, fastened by bronze bands. Steam and blow-over pipes of wrought iron, covered with lead, and into which a lining of lead piping has been forced, have been recommended. A particularly vulnerable portion of the blow-over pipe is the elbow at the point at which the pipe turns towards the draining trough. A stoneware elbow with an iron cover has proved to be best. When the lead lining of the supersaturator was damaged, it was replaced by a lining of acid-proof stone; and the connection to the saturator was lined with a stoneware pipe. But these proved unsatisfactory. The supersaturator was, therefore, again lined with lead; but in the middle, over the lead lining, a thin iron sheet was placed, and screwed to the base—the screws and iron plate being finally covered with lead. This arrangement prevented the lead lining from being torn-up by the fluctuations of temperature. Stoneware was tried for the pipe carrying the vapours through the roof from the saturator; but it soon became very brittle, especially the part above the roof. Wrought iron covered with lead is recommended for the construction of the draining trough. The masonry foundation of the hydro-extractor is protected from the destructive action of the liquor by a covering of lead.

The second paper referred to deals mainly with certain difficulties encountered in the manufacture of ammonium sulphate from ammoniacal liquor. The chief source of trouble is the increase in volume of the contents of the saturator due to the steam-ammonia supply containing too low a percentage of ammonia. Steam with an ammonia content of from 12 to 15 p.ct. should be employed. Among other difficulties encountered are included the stoppage of the preheater with lime, and trouble due to the ammoniacal liquor containing tar. The use of 20 p.ct. sulphuric acid is recommended.

Coal Tar.—Another of the extensive series of "Pitman's Common Commodities and Industries" has been issued—this time on the fascinating subject of "Coal Tar and Some of its Products." Pending opportunity for fuller notice of the book, it may be stated that the author is Mr. Arthur R. Warnes, F.C.S., A.Inst.Mech.E., Lecturer on Coal Tar Distillation at the Hull Technical College, and that it is published by Messrs. Sir Isaac Pitman and Sons, Ltd., of No. 1, Amen Corner, E.C., at the price of 2s. 6d. net.

"CONTROLLED" COAL AND THE GAS INDUSTRY.

By Norton H. Humphrys.

Some of the facts elicited at the Coal Commission inquiry are very interesting reading to purchasers of coal in quantity, who have not been accorded anything like fair consideration, either from the Coal Control Department or the colliery owners, as throwing some light on hitherto inexplicable matters of diverse nature and origin, but all moving in the direction of extortionate prices, and absolutely no security as to quality or value received. They go a long way towards unearthing the primary cause of labour unrest so far as the miners are concerned, to say nothing of wider issues, such as the way in which a control, ostensibly established for the benefit of the user, can be utilized as a means of taking large profits from him, and the general connection of the subject with export trade and national prosperity.

Confining attention to the matter as it concerns the gas industry—which is too frequently regarded as limited to the operations of the gas undertaking, though it really includes users of gas for power or other industrial operations, if not consumers of any class—it is evident that a clear case exists for strong action on the part of the National Gas Council. Gas undertakings, as representing the shareholders, are rightly urged to support this Association. But a man who spends £500 per annum on gas, is as much interested in the doings of the Council, so far as they refer to the selling price of gas, as one who has invested a like amount in gas stock. All are concerned in the obvious fact that the Government, the coal owners, and the miners, agree on one point—that there is no limit to the price that it is possible to extract from the users of coal. This has been carried to such an extent that it is quite time the gas industry (in the full sense above indicated) should declare with no uncertain voice that there is a limit which, if exceeded, leads steadily towards individual and National commercial ruin; and this limit was reached last July.

The representative body should also press for an explanation of the glaring disparity between the treatment accorded to coal (not to mention other industries fortunate enough to command powerful influence in Parliament) and the gas industry, as exemplified by the following comparisons:

Coal.	*Gas.*
Threefold increase of profits, on pre-war rates. Bounties to mines unable to earn a profit.	Profits cut to a maximum three-quarters of pre-war rates. Hindrance, expense, and heavy limitation on redress for non-paying concerns. Fixed selling rates and other restrictions on residuals, regardless of war conditions and other circumstances affecting their market value.
Watering of capital is so general that the nominal rate of dividend is no indication of actual profit on the investment.	Dividend strictly limited to the face-value of the investment.
Prices not only increased without notice, but made retrospective.	Advance notice of increase expected, and retrospection forbidden.
No protection as to quality or value supplied.	Limited allowances subject to strong opposition.
Controller seizes 10 millions sterling.	Issues of new capital, whether for extensions or increase of working reserves, subject to all sorts of vexatious delays and restrictions.

At about Midsummer, 1918, the price of coal was advanced 6s. 6d. per ton, with, if anything, a further reduction on the inferior values rendered possible by Government control. After adjustment for residuals, this infliction was equivalent to from 7d. to 10d. per 1000 c.ft. of gas sold—practically about the same as the proportion required to make up full dividends. And no dividend, however small, can be paid unless the Government first get their full pound of flesh in the shape of the full income-tax (whether due or otherwise) of 6s. in the pound. The full tax represents from 2½d. to 3d. per 1000 c.ft., or near the same figure as the Government share in the last advance. Either the coal owners' profits, or the Government profits, taken singly, exceed the amount available for the shareholders; and gas engineers, ostensibly working for the shareholders, are really doing more for the benefit of the Government and coal owners. At the same time, the public are very naturally protesting against high prices of gas, and fixing the whole of the blame on the management or the cupidity of gas undertakings. They should be informed as to the facts that taxation on gas, direct and indirect, is far and away out of all proportion to the general run; that profits supposed to go to the shareholders are taken by the Government and the mine owners; and that the price of coal is not a matter confined to purchasers, but is of National importance as intimately connected with food questions and export trade.

The successful introduction of profit-sharing schemes has naturally attracted the attention of labour interests, who are gradually coming to regard weekly wages as a share of profits, rather than remuneration for services rendered. And, unfortunately, many are not sufficiently educated in political economy to appreciate the full bearing of the subject, but regard it from the narrow perspective ascribed to the fat boy in "Pickwick"—less work, more meat, more beer. The awkward part is the absence of any basis for a fair proportionment of profits between capital and labour other than that brute force, irrespective of right, that we have sought to prevent, in respect to other countries, at the expense of 10 p.ct. of our armies, and a loading of debt that will for fifty years set us a long way back in our position as a nation. Ideas vary in accordance with political views, and extremists urge that labour has a right to the whole. This has been the *crux* of the coal market for years; labour being in pursuit of a larger share in the profits, and repeatedly aggravated by the fact that for every additional shilling accorded to them the owner gets another sixpence. And when the miner sees not only a threefold increase in owners' profits, but the Government taking 20 millions sterling by a stroke of the pen, on the part of one official, no wonder if they ask "where do we come in," and also notice that the increase of 6s. 6d. was accepted without protest, and apparently caused no evident hardship. If they have a lax view as to any responsibility to the purchaser or the nation, the Government have set the tune.

Another point that has strengthened the miner in the belief that the present is an opportune time for enforcing his demands is the depletion of gas-works stocks throughout the country, which, by the action of the Coal Controller, have been kept below anything like safe limits, even for ordinary times. Low stocks have been a plank in their platform for many years past, and the Government has danced to their tune. What would have been the consequence of a heavy snow fall during the past winter, such as that experienced in 1894-5?

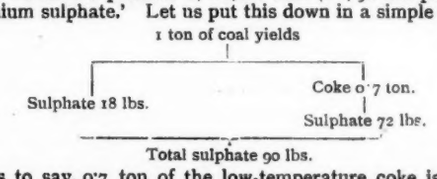
These things are instructive as to the methods generally followed by controllers, and may be applied to Government control or ownership in any form. It is no benefit, but, on the contrary, a heavy tax on the consumer, whether applied to coal, meat, sugar, housing, or cheap [?] electricity. Much has lately been said about more publicity; and evidently this might apply to the finances of Government control departments.

Since writing the above, current American gas magazines have arrived; and the following are well worth mentioning:

A trenchant article against Public Ownership, published in the American Gas Engineering Journal, concluding with the following paragraph: "Government ownership in any form is a menace to democracy. It is autocracy enthroned. It could delay and hinder the transportation of the goods of the manufacturer or the merchant opposed politically to the party that happened to be in power. It could lose the newspapers that criticized it on their way to their readers, and in the hands of a fourth-rate politician it could reduce this country to industrial slavery where the people only dare to obey, like that which made Germany a menace to the world." The prominence accorded to schemes for merchandizing and promoting new business indicates active progress in all parts of that country. Market reports in the "Gas Age" state that the supply of coal is more than adequate for all needs, and that current quotations at the mines are about equivalent to 14s. per ton f.o.b. tide water at the mines, or 22s. in New York City.

Low-Temperature Carbonization.

Referring to the article by Mr. F. D. Marshall, on "Low-Temperature Carbonization," which appeared in the numbers of the "Journal" for Feb. 25 and March 4, Mr. W. Colquhoun, of Sheffield, wrote to the "Iron and Coal Trades Review:" "Mr. Marshall said: 'By the preliminary low-temperature carbonizing process 570,000 tons (*i.e.*, say, 18 lbs. per ton) of sulphate of ammonia is obtained (from 70,000,000 tons of coal), but by converting by the secondary operation the coke into power gas . . . we should produce 2,810,000 tons (*i.e.*, 90 lbs. per ton) of ammonium sulphate.' Let us put this down in a simple form:



That is to say, 0·7 ton of the low-temperature coke is to yield 72 lbs., or over 100 lbs. of sulphate per ton. Does any gas producer working on coke fuel and making gas of the volume and value Mr. Marshall predicates, yield 100 lbs. of sulphate, or even a sufficient quantity of sulphate to recoup the cost of the recovery plant, even if 9 to 12 p.ct. of volatile matter is left in the coke? It is at least known that in gasifying gas-works coke fairly high in volatile matter, the producer temperatures are too high for ammonia recovery." In the course of his reply, Mr. Marshall said: "I repeat that, if the original coal contained 1½ p.ct. of nitrogen, the coal, if completely gasified, would yield in a good producer 60 lbs. of sulphate per 1 p.ct. of nitrogen, or 90 lbs. for 1½ p.ct. of nitrogen. If by first treating the coal by a process of low-temperature carbonizing, and thereby eliminating nitrogen equivalent to 18 lbs. of sulphate, there remains in 0·7 p.ct. as 14 cwt. of the low-temperature coke, the nitrogen in this representing 72 lbs. of sulphate, this would represent 93·6 lbs. of sulphate per ton of coke, not over 100 lbs. Though it may seem paradoxical that the coal would only yield 90 lbs., whereas a ton of the coke from the same would yield 93·6 lbs., it must be borne in mind that, just as the percentage of ash in the original coal is concentrated in the coke produced from the same, in the form of an increased percentage, so it is with the nitrogen contents of the coal, as neither the ash nor the nitrogen can escape."

DISTRIBUTION OF LIGHT, HEAT, AND MOTIVE POWER BY GAS.

By Sir Dugald Clerk, K.B.E., D.Sc., F.R.S., M.Inst.C.E.

[**Extracts from a Paper read last Wednesday, at the Meeting of the Royal Society of Arts—Lord Moulton presiding.**]

At our present rate of consumption and export—about 250 million tons per annum—our British coal supply will be exhausted in 500 years. But the rate of mining is increasing; and if this continues without change, our coal will end in less than 200 years. The problem of coal conservation, therefore, possesses an importance far greater than that of mere technical interest. It concerns our whole population in a vital manner; and it forms a most appropriate subject for the consideration of men so widely separate as the Prime Minister and Mr. Smillie.

It is a matter of vital importance to conserve all our sources of heat and mechanical energy; but, in considering how to do it, many difficulties arise. The first thing to bear in mind is the impossibility of the creation either of matter or energy by any action of man or machine. No progress in science can create energy, though some writers in the Press appear to think otherwise. The idea that energy can be created in some unknown way is still held by members of the public; and the word "electricity" at once brings up the idea of some mysterious process by which this is accomplished.

Science has disclosed many strange and hitherto unknown facts; but in the midst of rapid advance, two fundamentals form the basis of all such reasoning—the indestructibility of matter, together with its uncreateability, and the indestructibility and uncreateability of energy.

We are all agreed, then, as to the vital importance of the coal and energy conservation problem. For more than a hundred years engineers have devoted much study and experiment to it. The results are seen in the development of heat-engines of different kinds (steam and internal combustion), in the development of the dynamo and the study of the laws of electrical generation and distribution, and in the rise of the gas industry, and with it the invention of the internal combustion engine, the bunsen burner, the incandescent mantle, together with the study of the chemistry of coal tar, and the formation of many chemical products used in the preparation of fertilizers, ammonia products, dyes from nitrobenzol, toluol, and other bodies for producing high explosives.

Importance of the Gas Industry.

In the year 1912 there existed 826 authorized gas undertakings, of which 520 were companies and 306 local authorities, and about another 800 non-statutory undertakings, mostly in villages and rural areas. A capital of some £170,000,000 is now invested in gas-works and the industries engaged in the manufacture of gas plant and gas consuming appliances. The gas industry carbonizes about 20 million tons of coal per annum, of an average estimated calorific value of 13,000 B.Th.U. per pound.

Efficiency of Gas Production.

The process is economical, as the average thermal efficiency of carbonization is approximately 71 p.ct. That is, after the completion of the process, the three main products—viz., coal gas, coke, and tar—are capable of evolving, on complete combustion, 71 p.ct. of the original total heat of the coal. Of this, 25 p.ct. is obtainable from coal gas, and 46 p.ct. from the coke and the tar. If we consider the whole of the heat used in the process (amounting to 29 p.ct.) to be debited against the principal product —coal gas—then, to obtain 25 heat units in the form of gas, it is necessary to use a total of $25 + 29 = 54$ heat units of the original coal. That is, the thermal efficiency of the gas-making process is $\frac{25}{54} = 0{\cdot}46$, or 46 p.ct.

Gas, like electricity, is ultimately used to produce heat, light, and motive power; and both services must be compared as to capacity and efficiency for supplying the three wants of the consumer. The accurate evaluation of each depends on a full knowledge of the relative division as to heat, light, and power of both systems. This is not definitely known, either for gas or electricity; and accordingly it is better and simpler to compare the capacities and efficiencies of each separately.

The capacity for generating heat will first be considered. From the figures just given, if the whole of the gas produced be completely burned, the heat evolved will be equal to that which could have been produced by the combustion of 25 p.ct. of the original coal, amounting to 5 million tons. But the efficiency of production of gas is 46 p.ct. So that $\frac{5}{0{\cdot}46} = 10{\cdot}86$ million tons of coal are used in the process (say, 10·9 millions), leaving still a heat-equivalent in the remaining coke and tar of 9·1 million tons of the original coal.

Thermal Efficiency of Electricity Generation.

The electrical industry of the country, according to Mr. D. Wilson, the Technical Adviser to the Coal Controller, in the year ending March 31, 1918, generated 4674 million electrical units on a coal consumption of 3·47 lbs. of coal per unit. The calorific value of the coal was 11,600 B.Th.U. per pound; the thermal efficiency of generation, 8·5 p.ct.; and the total consumption of coal in the year, 7·3 million tons. This coal is of lower thermal value than gas coal, in the proportion of 11·6 to 13. Correcting for this, $7{\cdot}3 \times \frac{11{\cdot}6}{13} = 6{\cdot}5$. Had the coal been of the same heat value as gas coal, the quantity consumed in a year by electricity would have been 6·5 million tons. The amount of heat which could be generated by the electric current actually produced is 8·5 p.ct. of the total heat of the coal; and $6{\cdot}5 \times 0{\cdot}085 = 0{\cdot}55$, shows that this heat could have been obtained by the combustion of 0·55 million tons of coal at 13,000 B.Th.U. per pound.

A Comparison.

Comparing, first, the present capacity for heat production of the two industries as now existing, the gas industry has $\frac{5{\cdot}0}{0{\cdot}55} =$ nine times the capacity of the electric industry. To supply the same amount of heat as the gas industry, the electricity generating undertakings of the country would require to consume $6{\cdot}5 \times 9 = 58{\cdot}5$ million tons of coal of the same calorific power as that used for gas. Gas only requires the consumption of 10·9 million tons; so that it is $\frac{58{\cdot}5}{10{\cdot}9} = 5{\cdot}36$. The thermal efficiency for the generation of heat quantity by gas is thus more than five times that of electricity. Taking the efficiency of transmission of gas and electricity as approximately 90 p.ct., the heat capable of generation by the consumer remains in the same proportion.

Thermal Efficiencies in Use.

So far, the discussion deals only with the relative quantities of heat energy which can be supplied to the consumer by the two systems. When the consumer receives his gas, he produces heat by its combustion; and the efficiency of its use varies with the nature and relative perfection of the apparatus employed for heating rooms, for heating and boiling water, for cooking ovens and other apparatus in domestic use, or for metal-melting furnaces or welding, or metal heating and tempering as used in factories. If the efficiencies of the electric apparatus required to produce heat in the home and the factory were the same as those of gas, then the thermal efficiency ratio would remain constant. This, however, is not the case. Thermal efficiencies vary considerably.

An examination has been made of the efficiencies of gas-fires as contrasted with electric radiators or heaters for rooms, for water heating, cooking oven, and metal melting. In heating rooms by gas, to apply 27 heat units to the raising of the room temperature by radiation and convection, requires the use of 100 heat units at the gas-works; while heating by electricity, for 7·6 heat units so applied, 100 heat units are used at the electricity generating station. Heating and boiling of water by gas, applying 22·5 heat units to the work, requires the use of 100 at the gas-works; while electricity only applies 3·8 heat units to this work for 100 at the station. For cooking by gas oven, applying 3·4 heat units uses 100 units at the gas-works; but electricity only utilizes 1·5 heat units for 100 used at the station. For metal melting, utilizing 14·4 heat units, gas requires 100 at the gas-works; and electricity utilizes 4·1 heat units for 100 at the generating station.

In Coal Conservation Gas Leads.

In all these cases a much greater heat quantity must be used at the electricity generating station than at the gas-works, to apply the same quantity of heat required for domestic and manufacturing purposes, varying from two-and-a-quarter to six times. In a general heat supply by both systems, the average value will depend on the proportion of the different types of use included in each system. With the proportions estimated as existing in the gas-heating services of the country, the probable value of the ratio of thermal efficiencies from user apparatus to gas-works or electricity generating station is about four. That is, electric heat supply, if substituted for gas heat supply, would necessitate the consumption of four times the fuel or thermal value. In this case, instead of consuming 10·9 million tons of coal annually, if the whole gas or current be converted into heat, 43·6 million tons would be required. From this, it is obvious that, in so far as electricity is substituted for the ordinary operations of heating by gas, coal consumption would be very seriously increased.

The Lighting Position.

The case is different, however, when light is produced by the two systems. Here also the efficiency of the apparatus of light production varies considerably. But to compare the best known of both, it is desirable to consider first the inverted incandescent mantle at ordinary gas pressure, and the so-called one-watt electric lamp. The inverted incandescent lamp requires the use of 47 B.Th.U. at the gas-works for each candle-power-hour obtained by the consumer. The one-watt electric lamp requires the use at the generating station of 54 B.Th.U.; but the half-watt lamp only requires 31 B.Th.U. Accordingly, if all the lamps used electrically were of the one-watt type, electricity would require a greater heat consumption than gas; but if all were of the half-watt type, then electricity would be more economical than gas. Again, all the incandescent burners used are not of the inverted type. A considerable proportion consists of the upright type, which is less efficient—requiring 82 B.Th.U. per candle-hour. If we assume the gas-lighting system to consist of equal

numbers of vertical and inverted burners, then 64 B.Th.U. would be required per candle-hour. High-pressure incandescent burners reduce the heat consumption to 23 B.Th.U. per candle-hour; and flame arcs in electric lighting come even below this economical figure—using only 15 B.Th.U. From these figures it is evident that the competition between gas and electricity in lighting is very keen; and conditions other than heat economy will determine as to the system to be applied.

Statistics as to the number of lamps, and the nature of the various types, in use in both systems are much required, in order to determine the most economical combination from the thermal point of view.

The Motive-Power Position.

The motive-power position is much less complicated. At about 75 p.ct. of full load a gas-engine of the ordinary type will deliver to the consumer as actual or brake-horse-power 11 p.ct. of the heat used at the gas-works to produce the necessary gas for distribution to the consumers; while an electric motor will deliver, also as brake-horse-power, only 6 8 p.ct. of the heat used at the electricity generating station. The efficiency of the gas power production and distribution is thus more than 1·6 times that of the electricity system.

Variations in Production Efficiencies.

The results which have been given refer to estimated average performances of the whole of the gas-works and the electricity generating undertakings of the country as in operation at present; but, as would be expected, there is some variation in the values given by the different gas-works and central stations.

The average thermal efficiency of carbonization has been arrived at by the examination of a year's working of large gas undertakings such as the Gas Light and Coke Company, the South Metropolitan Gas Company, and other London and Provincial companies. The efficiency values for the generation of electricity have been taken from the statements of Mr. David Wilson, the Technical Adviser to the Coal Controller. Both systems show that, in individual cases, much higher efficiencies are at present obtained than the average figures.

Prof. J. W. Cobb, C.B.E., B.Sc., gives the following values as obtained by tests made at a single gas-works:

Thermal Efficiency of Carbonizing Gas Coal in Horizontal Retorts.

Gas produced	23·5
Coke sold	52·6
Tar produced	6·6
	82·7
Heat used and lost in manufacture	17·3
	100·0

The late Mr. J. G. Newbigging made long-continued trials of continuous vertical retorts with the following results:

Thermal Efficiency of Carbonizing Gas Coal in Continuous Vertical Retorts.

Gas produced	23 6
Coke sold	53 5
Tar produced	5·1
	82·2
Heat used and lost in manufacture	17·8
	100·0

In these two cases the thermal efficiencies of carbonization are respectively 82·7 and 82·2 p.ct., instead of the average 71 p.ct. The two efficiencies of production are, therefore, 57·7 and 57·2 p ct. on the assumption that the whole heat loss of the process is debited against the principal product, coal gas. If all the gas-works of the country operated the same as the two examples given, then the thermal efficiency of production would be 57 p.ct. instead of only 46 p.ct. As $\frac{57}{46} = 1{\cdot}238$, the thermal efficiency would be raised by 24 p.ct.

Mr. David Wilson, in discussing the thermal efficiency of the generation of electricity throughout the country, stated that there are altogether 421 steam-driven central stations, producing in one year 4674 million Board of Trade electrical units on a consumption of 3·47 lbs. of coal per unit, at the thermal efficiency of 8·5 p.ct. Of these 421 stations, 381 produce a total of 2399 million electrical units on 4·32 lbs. of coal per unit, at an efficiency of 6 8 p.ct. The remaining 40 stations produce 2277 million electrical units on 2·57 lbs. of coal per unit, at a thermal efficiency of 11·5 p.ct. Of these 40 stations, one produces over 40 million units on a consumption of 2·32 lbs. of coal per unit, at a thermal efficiency of 13·05 p.ct.

If all the electricity generating stations of the country could be raised to the efficiency of the best single station, then the thermal efficiency of generation would be 13 p.ct. instead of 8·5 p.ct. As $\frac{13}{8{\cdot}5} = 1{\cdot}53$, the thermal efficiency would be raised by 53 p.ct.

The power of heat generation per pound of coal consumed at gas-works or in electricity generating stations on the average is $\frac{\text{Gas}}{\text{Electricity}} = \frac{5{\cdot}36}{1}$; so that, allowing for the highest existing efficiency of both, it becomes $5{\cdot}36 \times \frac{1{\cdot}24}{1{\cdot}53} = 4{\cdot}34$.

At their present best results, electricity is still inferior to gas in power of producing heat in the ratio of 1 to 4·34. Taking the value 4 as calculated for the average result of the country (including consideration of the relative efficiencies of apparatus in use for gas and electricity), the ratio becomes $4 \times \frac{1{\cdot}24}{1{\cdot}53} = 3{\cdot}24$. Assuming the same heat-using apparatus to be in operation with current supplied with the thermal efficiency of the best station, and gas supplied also equal to the best example, gas will deliver to the consumer 3·24 times the heat obtained by electricity for a station or gas-works consumption of (say) 1 lb. of coal in each.

Improved Lighting and Motive Power Efficiencies.

In the production of light, the case of electricity is now improved relatively. The one-watt lamp requires 35 B.Th.U. to be used at the generating station; while the half-watt lamp only uses 20·4 heat units per candle-hour. The inverted incandescent gas-burner uses 36 B.Th.U. per candle-hour. So illumination by a one-watt lamp and an inverted incandescent burner would consume practically equal amounts of heat for equal light. If, however, the whole illumination of the electrical system could be accomplished by half-watt lamps, then electricity would have considerable advantage over gas. It would only require, per candle power, $\frac{20{\cdot}4}{36} = 0{\cdot}567$ of the heat units used by gas.

This assumes that gas lighting is wholly accomplished by inverted incandescent burners and electric lighting by half-watt lamps. But high-pressure incandescent burners produce light on a consumption of 19 B.Th.U. per candle-hour; and if only they could be adapted to the smaller power lights used for interior illumination, gas would again show a thermal efficiency equal to electricity.

Flame arc electric lamps give the still lower consumption of 9 B.Th.U. per candle-hour. So that if they could be utilized for smaller lights, they would further reduce the heat consumption of the country for producing light.

With regard to motive power, under what may be termed the best gas-works and electricity generating conditions the gas-engine gives a return of 13·6 p.ct. brake-horse-power for 100 heat units used at the gas works, while electricity returns 10·4 p.ct.

In motive power gas has still a distinct thermal advantage over electrically transmitted power. And from these facts it follows that the real competition between gas and electricity, from the point of view of coal conservation, arises in the field of illumination, and not in that of heating or motive power.

Claim to Electrical Superiority over Gas in Coal Economy not Justified.

But some eminent electricians think differently. For example, Mr. Ferranti stated, in his presidential address to the Institution of Electrical Engineers in 1910:

> It papears that with a problem such as we are discussing, it is fundamental that the energy in the coal should be converted at as few centres as possible into a form in which it is most generally applicable to all purposes without exception, and in which it is most easily applied to all our wants, and is, at the same time, in a form in which it is most difficult to waste or use improperly. We are, therefore, forced to the conclusion that the only complete and final solution of the question is to be obtained by the conversion of the whole of the coal which we use for heat and power into electricity, and the recovery of its bye-products at a comparatively small number of great electricity producing stations. All our wants of power, heat, and chemical action would then be met by a supply of electricity distributed all over the country.

This opinion of Mr. Ferranti's in 1910 forms the basis of the super-station proposals of which we now hear so much in the reports of Official Committees, in the Press, and in Parliament. The general sense of the articles written by supporters tends to the belief that, by substituting electricity for gas, great coal-saving would be made throughout the country. From the foregoing discussion it is evident that, so far as concerns heat and motive power, a great fuel loss would be incurred by this substitution and it is only in the case of lighting that electricity competes substantially with gas.

Gas and Electricity Both Indispensable.

The engineers of the gas industry fully recognize the important position now filled by the distribution of electricity from central stations; and they wish to co-operate with electrical engineers in producing the necessary electrical supplies in the manner best calculated to conserve the vital coal resources of the country. They desire to point out, however, that gas and electricity are both required for the purposes of our civilization; and that for progress in both industries it is necessary for them to develop in friendly rivalry—each performing the task for which each system is specially suited. It is necessary however, as a preliminary, that the electrical engineers should recognize the limitations of electricity distribution and use, as well as its undoubted superiority for some special purposes. Mr. Ferranti's claim to superiority over gas in coal economy—that is, the conservation of our coal supplies—is not, however, justified by facts.

Super-Power Station Thermal Efficiency.

The report of the Coal Conservation Committee recommends the erection of a small number of great central electricity generating stations. Sixteen is the number suggested, in units of about 50,000 kilowatts; and the distribution of current throughout the country for use in producing heat, light, and motive power. A

higher thermal efficiency is promised for these great stations than is obtained by the best station in operation at present. The coal consumption suggested is 1 lb. per electrical horse-power-hour—that is, 1·34 lbs. per electrical unit. Good coal would be required for this. So 13,000 B.Th.U. per pound is taken; and at this value the thermal efficiency of electrical generation would be 19·6 p.ct. The best station of to-day gives 13 p.ct. So that the proposed super-station would give $\frac{19·6}{13} = 1·5$ times its efficiency. The average of the electricity generating stations of to-day is 8·5 p.ct. thermal efficiency of generation. So that the proposed efficiency of the great super-stations will be $\frac{19·6}{8·5} = 2·3$ times the average value.

Gas Industry's March to Higher Producing Efficiencies.

But great improvements are also proceeding in the gas industry, whereby the thermal efficiency of gas production will be greatly increased, and a larger proportion of the heat value of the coal transferred to the gasholder. The main efforts of the gas industry have been devoted during the past century to increase the yield of illuminating gas per ton of coal carbonized, and to the improvement of the percentage efficiency of gas, coke, and bye-products production. So long as high intrinsic illuminating power was imperative, development proceeded along the line of increased economy of fuel in carbonizing by the use of regenerators and other contrivances. This led to improvement in the efficiency of gas production. But the volatile contents of the coal dealt with imposed a limit on the yield per ton of what is called straight coal gas—that is, coal gas produced by distillation only; and accordingly a limit was attained when about 25 p.ct. of the original heat of combustion of the coal appeared in the station gasholders as inflammable and illuminating gas. Thus 75 p.ct. of the heat remained to be accounted for by the heat value of the coke made, the tar and oil separated, and the heat required for the process of carbonization and other secondary processes—such as steam-raising for pumping, driving exhausters, and the other mechanism of modern gas-works.

Obviously, greater financial economy would follow if a larger percentage of the total heat of coal could be delivered in the form of gas to the station holders. As all the volatile matter of the coal had been driven off in the retorts, it became necessary to convert the carbon itself into inflammable gas. Hence arose the water-gas and carburetted water-gas processes, now so largely used to supplement the distillation process. These operations depend on the endothermic chemical reaction of incandescent carbon and steam. When steam is passed through incandescent coke at a temperature of about 800° C. and above, some heat is absorbed and the reaction is broadly—

$$C + OH_2 = CO + H_2.$$

When the temperature falls to 600° C. and lower, the reaction becomes—

$$C + 2OH_2 = CO + 2H_2.$$

Both reactions absorb heat—the first somewhat more than the second; and both result in the development of nearly equal heating value from the gas produced by a given weight of carbon. In the first case, however, the whole (theoretical) product is combustible, consisting of 50 p.ct. of CO and 50 p.ct. of H by volume. In the second case, the composition is $33\frac{1}{3}$ p.ct. of CO_2 and $66\frac{2}{3}$ p.ct. of H. In the first case, the carbon and water reaction produce relatively two volumes; in the second case, three volumes are produced. But one volume consists of the inflammable gas, carbon dioxide.

Having traced the development of the water-gas process from Ibbotson (1824), through Lowe and Tessié du Motay in America, to Dellwik, Sir Dugald said: Dellwik's apparatus raised the gas-producing efficiency from 66 to 76 p.ct. Water gas without oil enrichment is known as blue-water gas; and its calorific value is about 300 B.Th.U. per cubic foot. If one volume of "straight" coal gas of 600 B.Th.U. per cubic foot be mixed with two volumes of blue water gas, the heat content of the gasholder per ton of coal carbonized is doubled. That is, it contains 25×2=50 p.ct. of the original heat of the coal producing it. The best efficiency of coal carbonization by horizontal or vertical retorts is, as has been shown, about 80 p.ct.; so that one-half of the heat value of the gas stored has 57 p.ct. of the heat of the coal consumed, and the other half has 76 p.ct. of that of the coke used to produce it. The combined efficiency of the mixed gas made separately and mixed after production is thus 66 p.ct.

Charge Steaming in Vertical Retorts.

If, however, the distillation and water-gas processes is combined, so that the waste heat of the water-gas production is applied (either externally or internally) to perform the work of carbonization, then the gas-producing efficiency of the whole process will be considerably raised—from 66 to 75 p.ct. by external heating, and probably to 80 p.ct. by internal. So, at this stage, it is desirable to combine the distillation and the water-gas reaction within the same apparatus. The continuous vertical retort system lends itself readily to a convenient and highly efficient design on the principle of heating-up by burning a small quantity of carbon to CO_2, and then passing steam superheated by the regenerator for the water-gas reaction and for distillation. The water-gas produced would then pass through the distilling coal from the lower to the upper part of the retort, and supply the heat necessary for distillation—carrying away with it to the gas-mains the coal gas as it was generated.

The excess heat of the blowing-up process would maintain the external temperature of the retorts, and be further utilized by the regenerator. Then the air for blowing, and the steam for decomposing, would both be heated regeneratively.

Effect of the Higher Producing Efficiency on Power, Light, and Heat Production.

By this combined process, 75 to 80 p.ct. would be readily obtained as the efficiency of gas production. The efforts of the gas industry are thus at present directed to the application of internal heating to all gas-making processes. Its members are encouraged in this work by the success of the engineers of the internal combustion engine industry—in the application of this principle to the evolution of the dilute fuel gas known as "producer gas." Many thousands of such gas producers supply power gas for gas-engines at a thermal efficiency of from 80 to 85 p.ct. Such efficiencies can also be obtained in coal-gas distillation and carbon gasifying processes by the special adaptation of internal heating. The separate manufacture and mixing of the two gases would thus give a gas-producing efficiency of 66 p.ct., while that of the combined internal heating system would be at least 75 p.ct. If half the original heat of the coal be produced as gas at 75 p.ct. efficiency, then the coal used for gas-making is 67 p.ct. of the total coal carbonized—leaving 33 p.ct. remaining for coke and tar, containing 33 p.ct. of the original heat of the coal.

With an efficiency of gas production of 75 p.ct., and that of distribution of 93 p.ct., the combined efficiency would thus be slightly under 70 p.ct. The efficiency of power production by the gas-engine would then be 0·25 × 0·70 = 0·175 (or 17·5 p.ct.); and the value for light and heat would improve in the proportion of 45 to 70 p.ct. That is, 70 p.ct. of the heat of gas production would be available to the consumer for heat production, and low-pressure inverted incandescent gas lighting would require a coal consumption at the gas-works of 30·3 B.Th.U. per candle-power-hour, instead of 47 B.Th.U., as is the existing usual practice.

New Comparison on the Basis of Higher Efficiency.

Comparing now the results aimed at in the future by the projected electricity super-stations, and the perfected systems of coal gas generation, it appears that, in the generation of heat, gas will produce 75 p.ct. out of 100 heat units used in the works to produce the gas; and the great electricity station will generate electrically 19·6 p.ct. of the heat consumed in the generating station. From the heat-generating point of view, gas is superior to electricity in the proportion of $\frac{75}{19·6} = 3·8$ to 1. For lighting, the low-pressure inverted incandescent burner would use at the gas-works 30·3 B.Th.U. per candle-hour at the consumer; while the one-watt electric lamp would now use 23·5 B.Th.U. at the station per candle-hour at the consumer. Electric lighting would thus be thermally the more economical. As to motive power, the use of 100 heat units at the gas-works would deliver 17·5 p.ct. as brake-horse-power to the consumer.

For the electrical generation of power, the efficiency of distribution, including station use of current, may be taken as 90 p.ct.; and the dynamo efficiency at three-quarter load may also be taken at the same value. The brake-horse-power supplied to the consumer would thus be 19·6 × 0·9 × 0·9 = 15·9. The thermal efficiency would be 15·9 p.ct., against 17·5 p.ct. obtained by gas.

Distribution of the Uses of Gas.

In the future, therefore, the only field in which electricity shows any possible thermal gain is in lighting. But even here the past record of gas invention shows that great developments are still probable. Gas is now in enormous and increasing use for light, heat, and motive power. Some 90 p.ct. of all town gas sold is used for illumination and fuel purposes, and 10 p.ct. for motive power by gas-engines. No official census of the gas industry has yet been taken; but an examination of reports from many gas companies shows the following division of heat, light, and power throughout the United Kingdom to be very probable:

Probable Division of Coal Gas Consumed in the United Kingdom.

Heat	55 p.ct.
Light	35 ,,
Motive power	10 ,,

Effect of Substituting Electricity for Gas.

Using the ratios already discussed, this enables an estimate to be made as to the thermal economic effect of substituting for the present general heat, light, and power service by gas, an electrical system distributing the three items in the same proportion—considering first the substitution of electricity at the present average of generating efficiency of 8·5 p.ct. to compare with the present average gas results, both as distributed to the consumer. For this, electricity would require, at the station, four times the heat consumption of gas. Assuming the use of equal numbers of inverted incandescent and vertical lamps for gas lighting at 64 B.Th.U. per candle-hour, and one-watt lamp electric lighting at 54 B.Th.U. per candle-hour, electricity would require $\frac{54}{64} = 0·84$ of the heat used by gas, and motive power $\frac{\text{Gas}}{\text{Electricity}} = \frac{11}{6·8} = 1·6$.

Electricity requires to use for unit power 1·6 times the heat of gas. The heat used by electricity for the system becomes:

Heat	55 × 4·00 =	220·00
Light	35 × 0·48 =	29·40
Motive power	10 × 1·60 =	16·00
	100	265·40

In this case the substitution of electricity for gas in a general service would increase the heat consumption at the central station as compared with the gas-works, from 100 heat units by gas to 265 heat units by electricity. If a comparison be made of the probable future of both systems, in heat generation the gas is still 3·8 times that of electricity for equal station and gas-works heat consumption. Allowing the same efficiency of use as first calculated—that is, $\frac{4}{5\cdot36} = 0\cdot746$, we get $3\cdot8 \times 0\cdot746 = 2\cdot8$. Even asssuming no relative improvement in the efficiency of gas-heating appliances, electricity requires 2·8 times the heat of gas. For gas lighting in the future it may be assumed that the inverted incandescent burner will become universal and the one-watt lamp practically so also. The heat consumption is then $\frac{23\cdot5}{30\cdot3} = 0\cdot77$ that of gas. For motive power, gas is the more economical in the proportion of $\frac{17\cdot5}{15\cdot9} = 1\cdot1$. The heat used by electricity for the systems becomes:

Heat	55 × 2·80 =	154·0
Light	35 × 0·77 =	26·3
Motive power	10 × 1·10 =	11·0
	100	191·3

In this case the substitution of electricity for gas, in a general service, would increase the heat consumption from 100 heat units by gas to 191 heat units by electricity.

Gas-Works Better than the Super-Station in Coal Conservation.

It thus appears that even assuming the success of the super-electric stations to be fully realized, yet a gas service is, from the coal conservation point, nearly twice as economical. That is, it requires half the coal consumption.

So far, then, as concerns the gas industry of the United Kingdom, the new proposed super-stations would not save fuel, but would waste it. There is no case for electricity for the production and distribution of heat energy. But there is a case in strong competition with gas for illumination; and as against the average reciprocating steam-engine of the country the advent of the steam-turbine of high efficiency shows a distinct advantage.

The statement made, however, in the report of the Committee on Coal Conservation—that 80 million tons of coal are at present consumed annually for producing motive power by steam and gas—is not supported by convincing data. The estimate, too, of an average consumption of 5 lbs. of coal per brake-horse-power-hour appears somewhat doubtful, in view of the known efficiencies of modern steam-engines of the reciprocating type. A careful census of motive power and fuel consumption in all its uses is urgently wanted in this country.

Gas-Engines Increasing in Power and Numbers.

The gas-engine continues to increase in power and numbers. According to the "Census of Production for 1907," internal-combustion engines using gas and oil in various forms amounted to 680,177 H.P. This power is much greater now [1919], and cannot be less than 1,500,000 H.P., judging from the number of engines built and sold since 1907.

The thermal efficiency of the internal-combustion engine is much higher than that of the most economical steam-turbines. The largest and best existing steam-turbines give a brake thermal efficiency of about 18·5 p.ct., referred to the coal consumption in the boiler furnace; and the gas-engine using producer gas made from coke or anthracite will give 28 p.ct., allowing for the efficiency of the gas producer which is high, from 80 to 85 p.ct.

These engines use town coal gas with a brake efficiency of 30 p.ct. of the heat of combustion of the gas; and they also use blast-furnace gas, coke-oven gas, and inflammable gas produced from waste wood, chips, and peat. These engines are most important factors in securing fuel economy; and they should be allowed freedom to develop in competition with steam-engines of all types as before. It would be a serious matter for the country if the development of these engines was hampered in any way.

A Warning.

Gas engineers fully realize the existence of a vast field for the generation of light and power by electricity. Electricity supplies energy for power in a convenient form for operating of electric railways, tramways, and small and medium power motors in factories of various kinds. It is also necessary for many electro-chemical processes for very high temperature metal welding and for all electrolytic processes. Its field is very wide; but its use as the one source of heat, light, and power sanctioned by legislation would be fatal to the prosperity of the country and would largely increase the fuel consumption, already high.

Agreement and Disagreement.

Gas engineers agree with some of the conclusions of the Coal Conservation report. It is obviously desirable that all coal used for combustion should first be carbonized, in order to obtain tar, ammonia, benzol, and other useful products. This, however, must be done in such manner as to render the gas produced available for distribution to the public. The worst use to which the gas could be put is to burn it in the furnace of a steam-boiler as proposed by the electricians. The only practicable method is to carbonize all coal at gas-works, and legislate to prevent the direct burning of coal, either for domestic or manufacturing purposes. Steam-boiler furnaces would then be adapted to consume the coke produced in gas-making, and an ample supply of cheap fuel would be available for the use of electrical generation and all other purposes.

Combination and Heat Economies.

The domestic fires of the country now consume about 36 million tons of coal annually. This quantity, together with 20 millions carbonized at gas-works, gives a total of 56 million tons for the production of gas, coke, tar, and other valuable products. The coke produced from this large quantity of coal is amply sufficient, together with the poorer available coal unsuitable for carbonization, to produce the desired increase in the generation of electricity and the heat needed for the household. At the same time, great quantities of good gas would be available at the lowest possible cost for 10,000 heat units. Wherever the conditions permit—as in municipalities owning both gas and electricity undertakings—the gas and electricity generation should be combined in one works; so that all waste heat could be very greatly reduced by the combination of gas-making and steam-raising as one unit. Great heat economies can also be obtained in this manner.

Apart from economies in generation and distribution, there is still a large margin for improvement in the construction and design of gas-consuming appliances for the production of heat, light, and motive power—so considerable that it is certain even better thermal results will be practicable in the early future.

The intensity of effort in the production of new devices will be greatest in the field of illumination, both with gas and electrical devices. Even in gas-engine efficiencies great improvements are probable. The movement as to larger gas-engine units is now proceeding, although at a somewhat slower rate than other gas improvements.

The Part of the Government.

The extension of the industrial stage of our civilization can only be made possible by the co-operation of the Government of the country with the gas, steam, electric, and hydraulic engineers, in order to ensure the full utilization of all our sources of heat, light, and motive power for the good of the community, even at the cost of legislative interference with the immediate profits of some industries. Great sources of energy on which we depend for our very existence should be conserved with the utmost care.

We have already upheld our position against the Germanic powers. It is to be hoped that we shall be equally successful against the powers of Nature.

DISCUSSION.

Lord Moulton said he was sure those present had been interested and impressed by the admirable paper to which they had listened. In all these great questions, they had to remember that, when they were dealing with science or industry, adjectival descriptions were no good; they must get down to figures. One laughed at the solemn tones in which the word "electricity" was pronounced by those who knew nothing about it. Papers wrote about ships being at last run by electricity, as if this meant that electricity could be generated in any other way than in the form of power. Of late, there had been a great outburst of this kind of thing in the newspapers—how we were waking-up to a sense of our powers, and that the blunders of all times were to be swept away, and that we were ripe to be given almost unlimited capacity by this marvellous agent—electricity. Now this kind of talk was no good. Those who had studied the subject knew perfectly that electricity was one form of energy, and heat another; and that they could, to the greatest nicety, calculate the cost of producing, and the advantage of using, the one or the other for any particular purpose. In the paper to which they had just listened, a man probably as fully cognizant of the whole of the industrial applications of heat as any man in the kingdom, had taken actual figures to test the soundness of the almost fanatical arguments they had been hearing as to the importance of burning all our coal in great super-power centres, and of distributing it in the form of electricicity all over the country, and that this would save a large amount of the treasure which the nation had in its coal deposits. In examining this, Sir Dugald had pointed out that, so far from the universal use of electricity leading to economy, it would result in a great waste of coal. Just let them see how this was. They knew perfectly well that in a lump of coal of a certain weight there was an amount of energy capable of being developed by being burned. This could be calculated to a nicety. It was latent there; and the question was how it could best be used for human needs. The first thing was to be kept warm; and from time immemorial people had had fires. They must have light. Then heat would do their work for them. A great change in the civilization of the world was the discovery of steam—that was to say, it was then found that they could, by the heat of coal, get brute force; could get their heavy tasks done by lumps of coal instead of human arms. This changed the whole history of the world. People then thought how they could accomplish the things that had before been done only by human agency—by harnessing this brute force of Nature. If the nation was to get the full value out of a piece of coal, the dominant need was to turn the energy of the coal into something which could be used in the house for fire, for light, and (probably to an increasing extent) for motive power—that was to say, they would have small engines to do their work, whether they were dynamos or small gas-engines. But the two principal needs were

warming and lighting. Now if they had to change the form in which the energy was in the lump of coal, they had to make a big sacrifice. If they wanted to turn it into motive power in the shape of electricity, the coal could be burned under a boiler to make steam; and with the steam they could turn their dynamos and get electricity. As Sir Dugald had pointed out, if they burned the coal under a boiler, the energy shrank-down to a very small fraction. In fact, in generating electricity, they lost—he was almost afraid to say how much—90 p.ct. of the energy, and under the very best conditions something over 80 p.ct. This was what they had to pay for turning the energy into electricity. There they had four-fifths of the energy sacrificed in order to change it to something which could be sent to their homes in the shape of electricity. The other way was to carbonize the coal, drive off a large portion of the combustible matter in the shape of gas, and the remainder partly as coke and partly as tar. They got the energy in a form in which it could be sent to the house. In making the gas, there was a loss, but nothing like so big as the loss from burning coal under a boiler. Something like 45 p.ct. of the heat of the coal was got in the gas distributed. Of course, if they were comparing merely the distribution of heat, electricity would not be in it; but the determining point was when they came to the use of the energy. Taking the question of heating first. Gas was readily burned. It could be burned just in the position and in the quantity needed. It was enormously better than coal, because they could start its use at any moment, and stop it at any moment. It had therefore a very great adaptability to household needs; and energy sent round in the shape of gas was therefore very useful. Take electricity; it could be turned back into heat. But they did feel it was a ghastly waste to burn the coal under a boiler and use four-fifths straight off for the purpose of turning the rest back into heat; and one was not surprised to find that the amount of heat that could be obtained (say) from 1 cwt. of coal, when used as gas, was very much greater—four or five times greater—than if used as electricity. Now coming to illumination, the case was very different. Electricity and heat were changeable just like bank notes and sovereigns. They were quantitatively changeable; but they could not get more than the exact equivalent of the heat in the shape of electricity or the exact equivalent of electricity in the shape of heat. When they came to illumination, this equivalent absolutely went. Illumination depended upon the temperature at which they developed the heat; not on the quantity. There was no law which said they could not eat-up the heat at a very high temperature. In fact, one of the peculiarities of the electric current was that they could use the whole, or substantially the whole, of the heat in it, in the smallest part of the circuit. This was the meaning of the incandescent electric lamp. They made their circuit waste practically little heat; and they made it as difficult as possible for electricity to pass through the lamp. So they had a small bit of matter, with a vast amount of energy expended upon it. There they had a very high temperature, and with this a large proportion of the heat was given off in the shape of light. Comparing gas, they could not get a high degree of temperature because gas must burn by the use of the oxygen of the air. In air they had five parts "clinker" [Laughter], and one part oxygen. He always looked upon nitrogen as a universal clinker. And it was the reason why they could not have temperatures anything like so high with gas as with electricity, with its wonderful power of concentration of heat. It was a piece of sheer good luck for gas that Welsbach hit on the peculiarities of rare earths which at the same temperature would give out a vast amount more light than other bodies. They did not understand it one bit more now than at the moment of its discovery how it could be done. But it was so. Therefore, while everyone could foresee that electricity would get in the years to come greater light—a greater proportion of lighting than when it commenced by reason of the improvements in the lamp itself, no one, even with the great triumph with regard to the rare earths in the incandescent mantle, could see any reason for thinking that we should never get beyond what had been accomplished by gas. Tungsten and tantalum had at present put it into the hands of electricity to give light at comparatively the same cost as the incandescent gas mantle. The early electric-lamps used 4 watts per candle power, which was four times the consumption of what one might call the ordinary electric lamp now used, and eight times that of a "half-watt" lamp, which had comparatively little use. Therefore electricity divided the field with gas for illumination. Coming to heat, the greatest waste of coal in a civilized country like England was to use open fires. If they desired to have an economical substitute for the open fire, then gas left electricity entirely out of the calculation. Gas would render the service that an open fire did, and with an economy of a most important magnitude. Electricity was not comparable to it in this service—in fact, he thought it was much the fault of the gas companies that they had not better shown the public how best to use this distributable fuel—whether for cooking or for warming. It could be done by more efficient appliances than those that were used now. This was a great field in which gas had no competitor. Considering the value in the household of distributed heat to take the place of the open fire—to do what the open fire used to do—the importance to civilization of using the energy in the shape of gas could not, he thought, be doubted. Everything had its own special properties; and the probability was that the highest civilization would make use of very many means of accomplishing its aims, because its aims were so varied; and it wanted to use each in a way in which its own special property would enable it to be applied. This was the lesson to be learned from the apparent rivalry of gas and electricity for the purpose of rendering as serviceable as possible to mankind the coal upon which we depend so much. Both gas and electricity were needed. One would be the better than the other in some circumstances and for the purpose of rendering some service. But the idea of driving-out one or the other would be retrograde, which would be a disgrace to our modern science.

Mr. F. W. GOODENOUGH (called upon by the Chairman) said, after the fascinating paper by Sir Dugald Clerk, and the illuminating remarks that had fallen from Lord Moulton, there remained very little to be said on the subject. He thought all present must have had a vision of a bubble bursting as Sir Dugald read his paper—a bubble blown in public during the past few months for the delight of the housewives and householders of the country. He (Mr. Goodenough) felt that there would be very great disappointment in many hamlets, villages, and farms in the country at the disappearance of the vision of that supply of cheap electricity which was going to do everything in the direction of heating, cooking, and power, throughout the country. No legislature could possibly sanction measures to foster proposals that would lead to such a ghastly waste of the fuel resources of the country (limited as they were) as would be entailed by substituting electricity for the coal now used in our homes. This had been shown by the figures put before the Society by Sir Dugald. Might he (Mr. Goodenough) interpret these figures broadly. The quantity of coal that was used at the present time for domestic purposes in the country, Sir Dugald had spoken of as 36 million tons; but a prominent official of the Coal Mines Deparment had stated that 40 million tons about represented the consumption of crude coal for domestic purposes. Taking the Coal Controller's estimate of the gas equivalent required to replace coal for fuel purposes, gas could do the service of the householder that was done by the 40 million tons of coal for a net destruction at the gas-works of 30 million tons of coal, or, taking Sir Dugald's estimate as to the possibilities of gas production in the future, for the destruction of 20 million tons of coal. But on the figures he quoted, it would take 120 million tons of coal destroyed at the average generating station to-day to give equal service by electricity, or 60 million tons with the thermal efficiency of something under 20 p.ct. promised on behalf of the super-stations. When they bore in mind, too, that the use of coal at the generating stations would see the destruction of all the bye-products that could be recovered if the coal were treated at the gas-works, electricity as the fuel of the future fell, he thought, still more completely to the ground. The figures Sir Dugald had given were borne out by practical experience, as for example by tests that he had made as to the relative work done by gas and electricity for cooking purposes. He had found that the practical cooking done by 100 units of electricity used in a modern cooker was equivalent to the work done by 1000 c.ft. of gas used in quite an old-fashioned gas-cooker. These figures would represent the net destruction of 75 lbs. of coal at the gas-works, and of 300 lbs. of coal at the average generating station of to-day; or 50 lbs. of coal on the gas practice of the future, as against 150 lbs. if the super-stations now proposed achieved their efficiency of nearly 20 p.ct.

Mr. W. H. PATCHELL asked whether he might be allowed to suggest to his friend Sir Dugald Clerk that the title of his paper ought to have been "Distribution of Light, Heat, and Motive Power, from the Thermal Point of View." Unfortunately, coal was not the monetary standard of the country. They had to look at everything from the financial point of view. If they had the currency in coal, he agreed with Sir Dugald that he proved his case up to the hilt. But some of his figures required amending. If gas was so very superior to electricity, he would ask why electricity had been so largely used for the purpose of driving the machinery upon which the war had mainly depended; practically in all cases the factories had been driven by electricity and not by gas. Until they gave up their partizanship and looked upon gas and electricity as tools, they would not do their best, and that best could only be served from the financial point of view.

Prof. W. E. DALBY, M.A., said he was perfectly certain, with the last speaker, that they had not to depend upon one form of energy, but that they should use them all as best served their purpose. Electricity was a means of transmission, and not a source of energy; and they wanted to adjust their ideas to the view that it was a most useful form of transmitting power or light.

General HILLS asked whether there was not a large improvement possible by abandoning altogether the view that gas required to be *per se* an illuminating agent. What was wanted was a supply of heating gas, and not illuminating gas. A heating gas which could be supplied at a lower price would come into use very extensively.

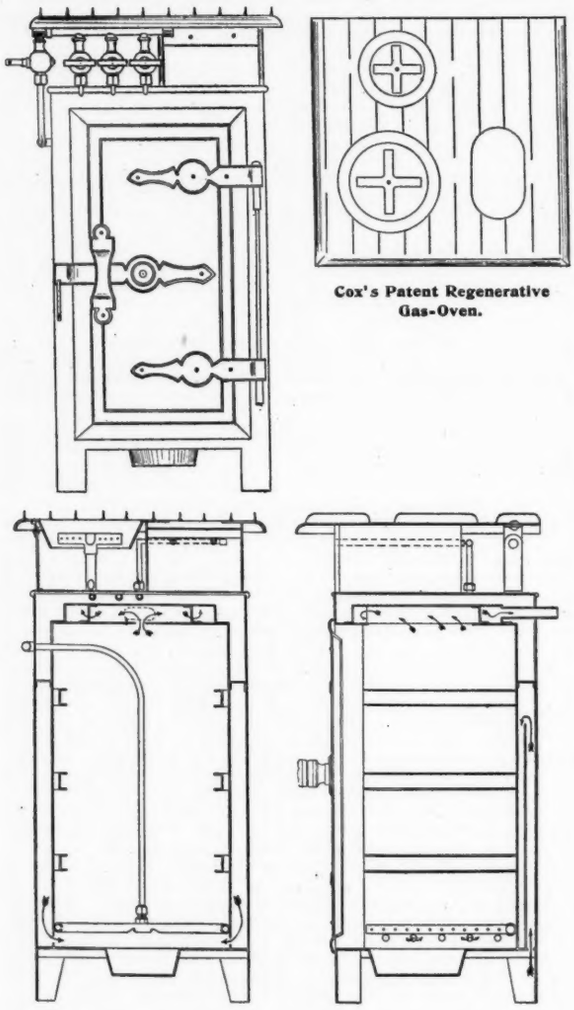
Col. R. E. B. CROMPTON said it was perfectly true, as the President said, that the idea of a world when the coal supply was exhausted was a very horrible prospect for the human race. And it was particularly horrible to a man when he was getting to an age when bodily heat was of great importance to him. He himself was approaching an age when he could sympathize with the cottager who cowered over a small fire. He wished to give him an electric radiator; for he would get his comfort with less units of coal burned, and why? Because those who wished to live comfortably did not want heat by convection or hot rooms, but they wanted to have something resembling sunlight; and the radiating power of the sun on their skins could be given them by the electric-radiator. They could give the old man, the old lady, and the invalid, radiators within a few feet of their skin; and the efficiency was then very high. The gas-fire had to be fixed on one side of the room; but the portable electric radiator could be taken to the old man's or invalid's bedside. He did not for a moment say that cooking by electricity was cheaper than by gas. He did not think it had been proved at all. But for heating, electricity, for personal comfort and convenience, possessed an enormous amount of good.

Sir DUGALD CLERK, replying to the discussion, said they were all greatly indebted to Lord Moulton for his admirable remarks. He had given them a useful summary of the transformation of energy and the causes of loss at different points. He hoped Mr. Patchell did not for one moment think that he was underrating the tremendous services which had been rendered to Britain and to the world by electricity. He made it quite clear in the paper that he was dealing with the thermal aspect of the question. Why he dealt with this was because it was the aspect taken in the Government reports; and the newspapers had been publishing leaders and articles suggesting that by distributing electricity coal was going to be saved. He wished to warn the country of the danger of this; and to do so he had taken out the efficiencies of relative orders. As Lord Moulton showed, electricity was admirably suited for lighting and power. The difficulty was that in cases where it was desired to use the highest thermal efficiency, electricity did not give the efficiency that could be obtained by gas-engines put into works in the ordinary way. He granted that there were some situations where it was found useful to put in an electric-motor. At the works with which he was associated (though they built nothing but gas and oil engines), they lit the whole place by means of electricity, and had electric cranes and machines driven

electrically. Electricity, as Prof. Dalby had rightly put it, was a good power transmitter. Mr. Patchell had mentioned another matter with which he (Sir Dugald) was not in agreement. The subject had been treated thermally; but if Mr. Patchall preferred going on the financial aspect, then he was in worse case than ever. Gas was a far cheaper source of heat and light energy. As to General Hill's remarks, he (Sir Dugald) was glad to say that the direction in which the gas industry was moving was towards the production of a heating gas. If they could get parliamentary sanction to it, there was no doubt it would be a far better thing to have a non-illuminating power gas with sufficient calorific power in it. The picture Colonel Crompton had painted of the cottager cowering over a wood or coal fire was touching [Laughter]; but he quite agreed with him that the portable electric radiator when a person was ill was useful in many ways. He noticed in the smoking room at the Athenæum that, while there were two or three men round the electric radiator at one end of the room, at the other end the men crowded round the coal fire. What he was protesting against was this campaign on behalf of electricity in the name of coal economy. Gas men were perfectly willing to compete in a friendly way with electrical men; but there must be fairness.

THE MAIDSTONE REGENERATOR GAS-COOKER.

In the course of his Presidential Address to the Southern District Association of Gas Engineers and Managers, Mr. Frank Livesey made appreciative reference to the Maidstone regenerator gas-cooker, which was patented nearly forty years ago by a gentleman connected with the Company, and many of which are still in use, though their manufacture was stopped at the time when the keen competition among gas-stove firms brought down the price of cooking apparatus to a very low figure.



Cox's Patent Regenerative Gas-Oven.

In reproducing the accompanying drawings, which have been forwarded by Mr. Livesey, it may be repeated that the principle of the stove (which he says still gives better results than most of the modern cookers he has tested), is that air is drawn in through the jacket round the oven, and through slots in the side of the cooker into the oven in proximity to the burners. After combustion, the gases are led away from the top of the oven through a baffling device. The advantage of the stove is that no lagging is required, as the stove is air-lagged—any heat passing through the oven side being taken up by the incoming air. Secondly, the amount of air passing through the oven is strictly limited by the size of the slots. The process of cooking requires a high temperature; and therefore to heat any unnecessary excess of air is very wasteful of gas, and will probably cause greater loss of weight in meat cooked than is necessary. The hot-plate of this cooker has no bars passing through the flames. A set of ladders is provided for carrying unsuitable-sized vessels.

HYDRAULIC MAINS OF REINFORCED CONCRETE.

A short communication to the Société Technique du Gaz, by M. Martineau, describes the successful result which followed the emergency measure of constructing ten hydraulic mains in reinforced concrete, undertaken as the only possible course during the war, in consequence of the high price of cast iron and the delay in getting such work completed. The metallic reinforcement consists of a network of ¼-in. round iron wire formed in squares 4 in. by 4 in. The concrete walls had a thickness of 2⅜ in. The walls of the main rest on I iron running the length of the retort-bench. The valve of the tar-outlet is let into the cement. A rebate along the upper part of the main receives the cover, formed of a slab of cement into which are set the inspection and cleaning boxes. Before being taken into use, all the interior surface of the main, as also the lower side of the cover, were given three coats of hot tar. This was done in order to close up the capillary passages in the cement, and thus prevent any action of ammonia upon the metallic reinforcement—the continuous flow of tar during the working maintaining this protective coating. The main was taken into use without any mishap in the way of expansion or leakage. Test pieces of cement placed in it at the time of commencing operations, and examined six months afterwards, showed no sign of any action on the cement by the ammoniacal liquor. M. Martineau expresses himself as wholly satisfied with the result of the measure imposed upon him by circumstances. The ten mains were constructed in six weeks, and the cost of each (1000 frs.) was much less than the quotation (2500 frs.) for the work in cast iron at the prices then ruling.

THIRY LOW-TEMPERATURE CARBONIZATION.

Arising out of the publication of the articles by Mr. F. D. Marshall we have received from M. Nicolas Thiry a brochure describing what M. Thiry calls his "Four de Distillation par Contact." It would appear from the description (which is not particularly clear) that the system contemplated by M. Thiry consists in providing a series of chambers ranging from 25 to 100 cb.m. capacity having an inlet at the head and a passage for the discharge of coke below. The chamber having in the first instance been charged with a sufficient amount of incandescent coke, the system of working the plant consists in discharging from the base (say) three wagons of the hot coke, two of which are raised by elevators to the upper surface of the bench of chambers, and there returned to the distillation chamber, together with one similar quantity of the material to be distilled. The proportion of coke thus returned to that of fresh coal added will vary according to the properties of the latter. The temperature of the mass in the chamber may also be increased by partial combustion through the admission of air at ports arranged for the purpose. Passages are also provided in the fabric of the chamber adjacent to the lower and upper parts—presumably employed for the exit of the hot burnt gases produced during the distillation. It is claimed by M. Thiry that from 500 to 600 tonnes may be distilled per day in a plant requiring the labour of only four workmen.

The Thirty-Sixth Annual "Informal" Meeting of Scottish Gas Managers will be held in the hall of the Royal Philosophical Society of Glasgow, No. 207, Bath Street, Glasgow, on Wednesday of next week [April 2], at 2 o'clock. The President (Mr. James Dickson, of Johnstone), will deliver an address.

There is to be a discussion by the Illuminating Engineering Society on "Light and Colour in Relation to Stage Production," in connection with which an introductory paper will be read by Mr. J. B. Fagan, of the Royal Court Theatre. The meeting is on Tuesday evening, April 8, at the Royal Society of Arts.

Lecturing before the Royal Meteorological Society last Wednesday, Dr. Leonard Hill, Director of the Department of Applied Physiology, Medical Research Committee, said he attached great importance to the radiant energy which poured into us when out of doors; and he believed the open fire or gas fire giving radiant energy was the right method of warming our misty climate.

The Minister of Munitions has announced that control of acids and fertilizers will be suspended on and after June 1. This will apply to sulphuric acid, sulphate of ammonia, superphosphate, basic slag, and compound fertilizers. All questions relating to the distribution of fertilizer materials will, on the release of formal control, be dealt with by the Departments of Agriculture. The continuance on a voluntary basis of the distribution of fertilizers at fixed delivered prices is now under discussion with the trades concerned; and communications should be addressed to the Commercial Secretary of the Board of Agriculture and Fisheries, No. 72, Victoria Street, S.W. 1.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Salaries in the Gas Industry.

SIR,—The advertisements under the heading of "Situations Vacant" in the last issues of the "JOURNAL" and your contemporary the "Gas World" are rather interesting.

In the first place an engineer and manager is required for a 160 million works (Mossley), the salary offered being £300 per annum; and then we find that Keighley requires a general foreman whom the Gas Committee are willing to pay £312 per annum. It is apparently recognized in the case of the foreman that the cost of living has increased—or is it that they know very well that no capable working man would take on the job at a less figure when he can obtain £4 to £5 per week as a stoker for eight hours per day (about four hours actual work)?

But how does the engineer and manager stand? Nowadays he is supposed to have received a good all-round education, to have served a pupilage of several years on a gas-works, studied numerous sciences, and then he is often willing to take a situation—possibly after acting as assistant for a few years—as engineer and manager at a salary frequently little better than a general labourer's, in the hope that it will lead to something better later on.

There are many undertakings in the country which do recognize that their chief technical officer is something better than a stoker or a gas-fitter, and have realized that he is quite as much entitled to increased remuneration as the manual worker who, by means of his trade union, gets practically all he wants. The trade unionist wants 5s., asks for 10s., and is pretty well certain what the result will be if the matter goes to arbitration.

The writer is acquainted with several engineers and managers of works considerably less than half the size of Mossley who are receiving from £350 to £500 per annum. Surely the latter figure would not be excessive, under present conditions, as a commencing salary for a 160 million works.

What is an additional £200 to £300 per annum to a works of this size? A little more than the wages of one stoker, and a sum easily lost many times over by bad management. The industry is bound to benefit by the all-round adoption of a reasonable scale of remuneration; for better men would be attracted to it. But it appears that such a state of affairs can in many cases only be brought about by a whole-hearted combination of the engineers and managers, works superintendents, and assistants of Great Britain and Ireland in one organization for personal protection and advancement. The Institution and District Associations exist for the purpose of forwarding the interests of the industry as a whole. Let them confine themselves to this good work.

March 22, 1919. ANONYMOUS.

Gas Appliances for Housing Schemes.

SIR,—While the article on this subject appearing in your issue of March 4 gives a good idea of the purposes that can be so successfully served by gas appliances (and this is beyond adverse criticism), no mention is made of the one domestic detail on which the use of some of these appliances hinges. It is of quite vital importance that consideration be given the method of warming the kitchen-living room; for on this depends much of the other equipment—certainly the supply of hot water to an upstairs bath, as will be shown. No reference is made to what shall be fitted in the room mentioned; whereas it is the room which will have the greatest use, and on which the comfort of the household will largely depend.

The reason for attaching so much importance to this point is that the one room in question requires warmth (or will be warmed) all day long in winter; and the point for consideration—and this has been something of a problem—is whether the means of warming this room shall be also applied to heat the contents of the hot-water apparatus. Whatever means may be adopted to warm the room, there will be at least several hours of the day when it can be reasonably felt that the heat may be partly diverted to some other useful purpose.

For the warming of the kitchen-living room a gas-fire is out of the question; for, however efficient this appliance may be, it is not one that should be in a worker's living-room which may be warmed fifteen to sixteen hours a day. Much as it may be regretted by those interested in gas, it has to be concluded that the coal (or mixed coal and coke) fire is the best for this room, though it is the only room in the house of which this can be said. And here arises the question, Shall it be an open grate or a kitchen range? The closed stove is out of the question in this country. Having decided this, shall the fire have a boiler behind it?

In the previous article it is apparently assumed that this room will be warmed by suitable means, while gas will be used exclusively for all else. The matter was the subject of a good deal of discussion when raised by the Committee appointed by the Local Government Board sitting at Whitehall; for a little thought will show it to be one that cannot be settled in a moment. And, while there may still be differences of opinion, the generally accepted idea is that of a coal-fired open grate for the kitchen-living room—this having a boiler behind it, with circulating pipes to a hot-water storage-tank.

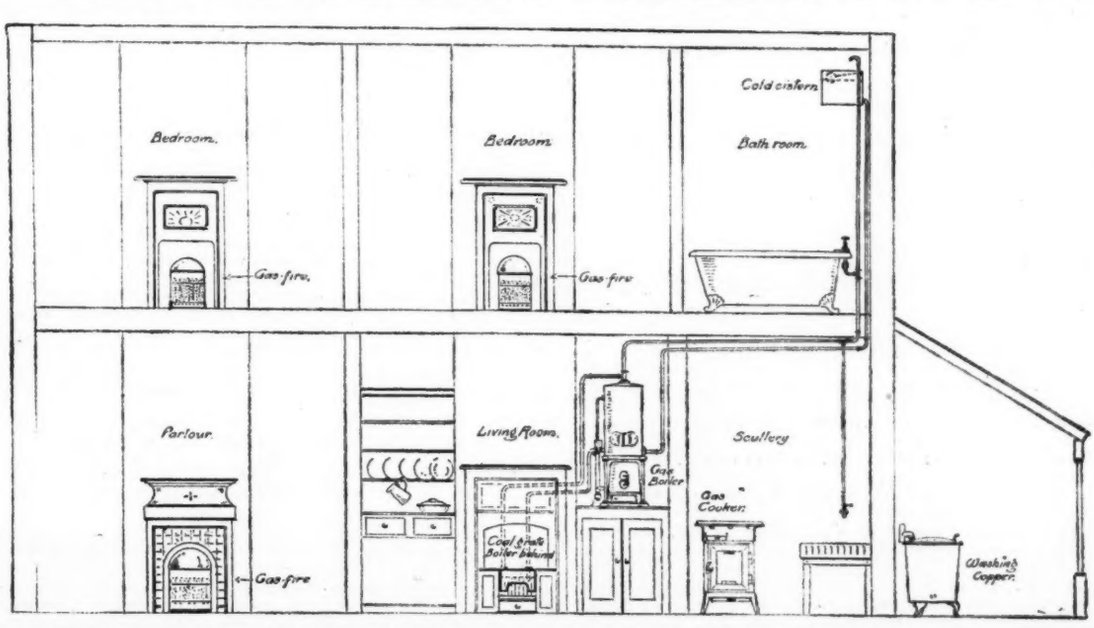
So far, although this may not seem very up-to-date, the arrangement appears to be as good as is possible. But it makes no provision for warming the water in the summer time, as it is not possible to have a fire alight in the room in question in warm weather. To deal with this problem, the gas-boiler (circulator) provides a solution—this being not merely a suggestion, but a practical proposition now being carried out in numbers of workers' houses erected in recent years.

To allow of the grate-boiler and the gas-boiler working together, as they should and must do, the connections are effected as indicated on the accompanying diagram, showing a house fully equipped in a way now being extensively adopted. It will be seen that, whether the grate-fire or the gas-boiler be in use, the water will receive heat; while, should emergency arise, both heaters may be working at once to meet some very unusual demand.

The "B.T.U." circulator shown is made up with storage cylinder (of 12 or 20 gallon capacity) complete; the two being connected by the customary circulating pipes, and a stand carrying the whole. The gas consumption is positively controlled by a reliable thermostat; while a specially designed "Economy" valve gives the storage tank two distinct active capacities. When open, the valve allows of the whole storage being heated, which is necessary when baths are about to be taken. But the bathing hours represent only a brief time per day or per week; and the purpose of the valve is to reduce the active capacity of the storage tank or cylinder to 5 gallons only for all the time that the water is not being heated for baths. A supply of 5 gallons of really hot water, always available, is ample for all domestic requirements other than baths; and to heat more than this quantity always, and to keep it always hot, is a waste of gas. The "Economy" valve is a great success.

A point may now be raised which, it is believed, has never before been publicly discussed. This is whether the gas circulator with its storage tank, if placed in the kitchen-living room, will not afford all the warmth the room requires, except perhaps on a few bitter days, and possibly at evening time, when a small coal fire may be desired for its cheerfulness. The circulator and its storage tank amount to a hot-water radiator with a good area of heat-emitting surface—sufficient to make comfortable a room of moderate dimensions when the outer air is at (say) 40° Fahr. or possibly lower. This being so, it will be seen that a source of marked economy is opened-up.

The idea of utilizing the warmth of the hot-water installation in the way just stated is not a theoretical one, but is the outcome of some observations during the past three winters. Rather over three years ago—before the labour shortage was so acute—one of the "Avenue"



A GAS-HEATING EQUIPMENT FOR COOKING, WARMING, AND HOT-WATER SUPPLY FOR DWELLINGS OF MODERATE SIZE.

estates was completed in the South of London, and in a number of these houses (sixty in all) a small gas-circulator, with storage tank, was fitted in the kitchens. At the end of the first winter, attendance was made at one of the houses on some small matter; and it was then noticed for the first time that there was no fireplace in the kitchen. The tenant was carefully sounded as to whether the kitchen had been uncomfortably cold. It was quickly seen that the idea was a new one to the tenant, who plainly stated that he had never noticed it, and it was obvious that the daily use of the circulator afforded all the warmth needed in the apartment. It was a kitchen—not a living room; but in this class of property the kitchen is occupied for a great part of the day. This rather striking discovery stimulated inquiry, with the result that on visiting three or four other houses (in company with the estate plumber) the same satisfaction was admitted. On a few other occasions since, at different places, no complaint has been heard. In a recent one the kitchen was of good size, in a high-priced flat in the west-end of London, occupied by two women servants who had to make it their sitting-room. They had not a word of complaint as to their comfort in regard to warmth during the winter months; nor, strange to say, in any instance was there complaint of any excessive warmth in summer.

Briefly, therefore, it is desirable that the living-room fire should afford warmth to the water when the fire is alight, while by placing the circulator and hot storage tank in the room the water can be heated by gas, and warmth given to the room by the same means when it is not desired to light the grate fire. The latter convenience makes it possible to have all-gas kitchens—*i.e.*, without the provision of a coal grate there. To have the gas circulator and its storage in the scullery, and a fire without a boiler in the living room, is not so economical a plan.

Fredk. W. Dye.

200, *Bedford Hill, Balham,*
March 21, 1919.

Wash-Boiler Tests.

Sir,—We would thank Mr. Oughton for his comments regarding wash-boiler consumption as given in our article in the "Journal" for the 4th inst.

The standard size 10-gallon capacity wash-boiler is made to contain the stated quantity when completely filled with water. In actual domestic use, it is not possible to completely fill it with 10 gallons, as a considerable portion of the working space is occupied by the articles to be washed. A safe limit has to be left for the water level when boiling. For economical working, we find that a gas consumption of 30 c.ft. per hour should not be exceeded.

We regret this letter did not reach you in time for publication in your last issue.

The Richmond Gas Stove and Meter Co., Ltd.

132, *Queen Victoria Street, E.C.* 4, *March* 22, 1919.

Eight Hours' Day.

Sir,—While thanking "A Country Gas Manager" for the expression of his opinion in the "Journal" for March 11, may I be allowed to point out that his reply in no way answers the question raised in my former communication—viz., how to apply the eight hours' day to very small works?

I referred definitely to works of less than 30 million c.ft., and particularly to those below 10 millions. He gives a scheme applicable to a works of 37 millions—a scheme which comes far short of what is usually understood as an eight hours' day, seeing that it involves two shifts of eleven hours, and one of ten hours, per week.

His statement that, "it should be easy" to work an eight hours' day on a works of 15 million c.ft. does not get the matter "any forrader," as it contains no helpful suggestion whatever.

Regarding 10-million works, he recommends increasing the make per man per shift. Then it no longer becomes a 10-million works! Following this suggested plan, a 6-million works might become a 10-million works. But how does this help to make for the introduction of an eight-hours' day?

Again he writes: "Even in the smallest of works more unskilled labour must be introduced." But I have already pointed out that (as is well known) in works of one million c.ft. and under there is not sufficient labour to provide a good day's work even for the one man already usually employed.

As for the remarks which constitute the remainder of his letter—statements reflecting upon the gas profession generally—I will leave your readers to judge as to whether they are in the best of taste. Personally, I will content myself by saying that I fail to see how they in any way assist in facilitating the introduction of an eight hours' day.

"Perplexed."

March 17, 1919.

Meter Makers' Wages in Australia.—Sitting in the Industrial Court, Judge Rolin disposed of an application by the New South Wales Amalgamated Tinsmith and Sheet Metal Workers' Society for an award for the gas-meter makers. Mr. Henwood appeared for the Union, and Mr. Sheridan for Messrs. Parkinson and W. & B. Cowan, Ltd., and other employers. The Judge said the case had given him a great deal of trouble; but he was of opinion that the last award must be taken on a 51s. basis. In clause 5 of the old award the following changes were made: Meter makers, from 1s. 4¼d. to 1s. 6⅝d. an hour; testers, 1s. 3d. to 1s. 5¼d.; second-class testers, from 1s. 1½d. to 1s. 3⅞d. The rates for apprentices, which ran from 15s. to 40s. in the old award, were altered to range from 17s. to 46s. per week. As to piecework rates, the Judge added a proportionate sum, the effect of which would be an increase of 9s. per week. He found that the average earnings of all the tin men in the shop worked out at present at 1s. 7d. an hour. It was the curious and unexplained fact that the earnings of so large a number of the better class of men nowhere (except in the case of one man, who took Saturday off) exceeded £4 a week, but remained steady at that point.

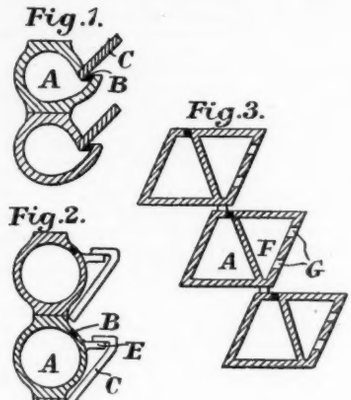
REGISTER OF PATENTS.

Gas-Fires.—No. 123,100.

Helps, G., of Nuneaton.

No. 1112; Jan. 23, 1917.

According to this invention, a gas-fire is formed by superposing horizontal tubes which (except the top tube) convey a mixture of air and gas the flames from which impinge on radiants arranged near to the orifices of the tubes. The radiants consist of removable fillets carried by lugs on the tubes, or they may be in one with the tubes, in which case the superposed tubes are divided into two parts, one of which constitutes the tube conveying the gaseous mixture and the other the fuel radiant.



Helps's Gas-Fire.

Referring to fig. 1, A are the horizontal tubes referred to—each provided with gas orifices B and fillets C supplied with a mixture of gas and air. In fig. 2, the horizontal tubes A are each, except the last, supplied with a mixture of gas and air, and each, except the bottom, tube provided with lugs which carry removable fillets C. In fig. 3 A are the tubes, each provided with a tubular portion F forming the radiant. This tubular portion leaves a space between the part heated and the burner A; but openings G may be provided for the flame to pass through. When the tubes are of considerable length, it may be desirable, the patentee points out, to provide gas and air inlets at each end.

Vertical Gas-Retort Arrangement and Operation.—No. 123,408.

Firth Blakeley, Sons, & Co., Ltd., of Dewsbury, and Shaw, E. J. A., of Hunslet, Leeds.

No. 3240; Feb. 23, 1918.

The principal object of this invention is to enable any desired number of retorts to be charged and discharged, and the residual coke quenched and removed by apparatus controlled by an operator on a central platform, instead of the operating gear for the purpose being located at different levels and positions.

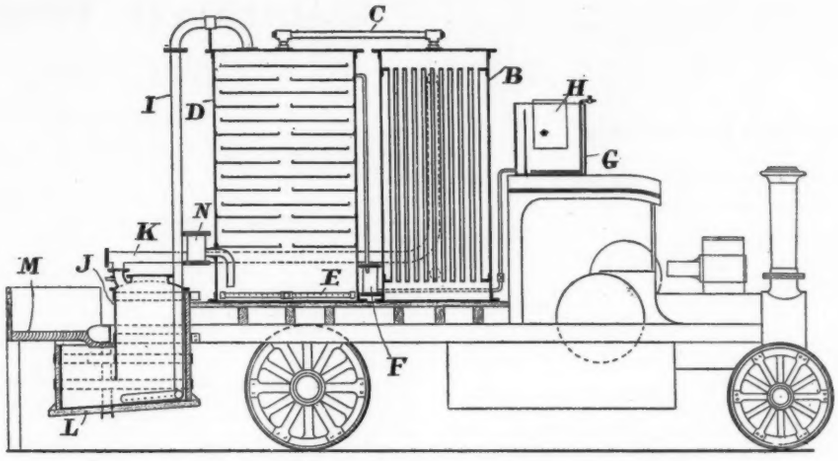
The claims made for the invention [which was fully described and illustrated in the "Journal" for March 4, p. 455] are: (1) Vertical retorts arranged in a circle or regular polygon, and each provided with a hopper adapted to be charged from a radial shoot travelling on a circular track over the hoppers. (2) A radial shoot as specified in Claim 1, supplied with coal, coke, or breeze from a central hopper, and carrying a seat for an attendant. (3) A radial shoot, as specified in Claim 1, provided with a rotary secondary arm and with valves controlling the exit of coal, coke, or breeze from the main outlet of the shoot and from the outlet of the secondary arm. (4) A vertical retort provided with sliding top and bottom lids, to which are secured racks engaging pinions on the horizontal shafts, one of the horizontal shafts being operatively connected to a vertical shaft, and either being actuated by one set of gearing, with a selecting clutch or lever. (5) A series of vertical retorts, as specified in Claim 4, having top and bottom lids actuated by shafts which may (by clutch mechanism) be caused to work in unison in such manner as to allow the simultaneous charging or discharging of all the retorts in the series. (6) The general arrangement of apparatus as described and shown in the annexed drawings [similar to those reproduced in the number of the "Journal" already alluded to.]

Treatment of Gas Liquor.—No. 123,337.

Croft, C. M., of Putney, S.W., Carr, H. O., and Nairne, U. O. S., of Wandsworth.

No. 7950; June 2, 1917.

This invention relates to means for avoiding waste of ammoniacal liquor produced at gas-works unprovided with ammonia-recovery plant, by providing a self-propelled vehicle combined with self-contained plant for treating the liquor, and in transporting the plant from place to place and utilizing it for dealing with the ammoniacal liquor "at a number of small works situated in different localities."



Croft, Carr, and Nairne's Movable Plant for Gas Liquor Treatment.

The illustration shows a self-propelled vehicle combined with a convenient form of self-contained apparatus or plant for carrying out the invention. It comprises a heater B, through the tubes of which the ammoniacal liquor is passed, preferably in an upward direction, while the waste gases resulting from the working flow in the reverse direction round the tubes. The heater communicates through a pipe C with the still D, where the free and fixed or combined ammonia from the liquor are driven off by the steam entering through the pipe E. The fixed or combined ammonia is liberated by milk of lime fed to the still by a pump F, which draws its supply from a lime tank G fitted with a strainer H and a partition plate. The pressure at which the ammonia leaves the still is sufficient to drive it through the pipe I into the saturator J, containing sulphuric acid. The sulphate of ammonia which crystallizes out of the acid is removed from the sloping floor L of the saturator on to the draining board M, whence it is removed to suitable receptacles to permit of its transportation. A spent liquor valve N serves to enable the waste liquor to be removed from the still. The waste gases and steam leaving the saturator pass along a pipe K to the liquor heater, where they enter the jacket surrounding the tubes and pass along in a downward direction. In this way the liquor is heated by the waste heat from the saturator. The condensed steam and waste gases leave the base of the jacket of the liquor heater, and are passed to a purifier.

Charging Retorts.—No. 123,441.

WEST, J., of Southport, and WILD, W., of Blackpool.

No. 5788; April 4, 1918.

This invention, relating to the charging of horizontal or inclined retorts, refers particularly to such retorts when adapted for continuous working; the material being fed into one end of the retort intermittently and causing an equivalent quantity of carbonized material to be discharged from the other end of the retort.

The patentees state that, by investigation and experiment, they have found it is essential that the quantity of coal fed into the retort must be placed between the coal being carbonized and the plunger or ram in such a manner that the plunger will act upon a layer of coal filling the space between itself and the carbonizing material, so that there is an even propulsive effort over practically the whole face of the material in the retort. Binding or wedging of the charge is thereby obviated. The ram or plunger proposed consists of at least two parts, one of which serves to propel the charge into a position in which it fills the space between the other part and the coal being carbonized in the retort, when the ram advances as a whole to feed the charge into the retort. The invention further comprises the employment of a ram or plunger made in two parts, one of which is directly connected to the power actuating means, while the other part is propelled from the former when the two parts have their acting faces in line with one another.

Fig. 1 is a sectional elevation of one application of the invention. Fig. 2 is a sectional elevation on the line XX of fig. 1 and fig. 3 on the line YY.

The feeding arrangement as shown is described in patent No. 113,981. The ram or plunger is divided into two parts; one part A (the upper part) being directly connected by the rod B to the power actuating means. These may consist of a hydraulic motor, serving to close the mouth of the coal shoot or hopper C after a charge has been received from it. The other and lower portion D of the ram is operated from the upper portion when the acting faces of the two portions are in line with one another, so that the two portions move together. There is an automatic catch piece E for holding the lower portion of the ram stationary until the upper portion is about to actuate it (due to the downwardly projecting part F of the upper ram engaging the cross member G of the lower ram), so that the catch is released from the hook H.

Assuming that the whole ram is in its rearmost position (as shown), coal can fall from the hopper C in front of the portion A and rest upon the top of the lower portion D of the ram. The upper part is then moved forward and pushes the coal off the lower portion into the space between the front face of the lower portion and the material being carbonized in the retort R. This space is gradually filled up; the upper portion of the ram closing the mouth of the hopper and finally approaching with its front face the position of the front face of the lower portion. The upper portion now releases the catch E (by the part F engaging the arm J of the catch) and finally effects the propulsion of the lower portion—coal being forced forward by one or both portions of the ram, according to the amount of the charge.

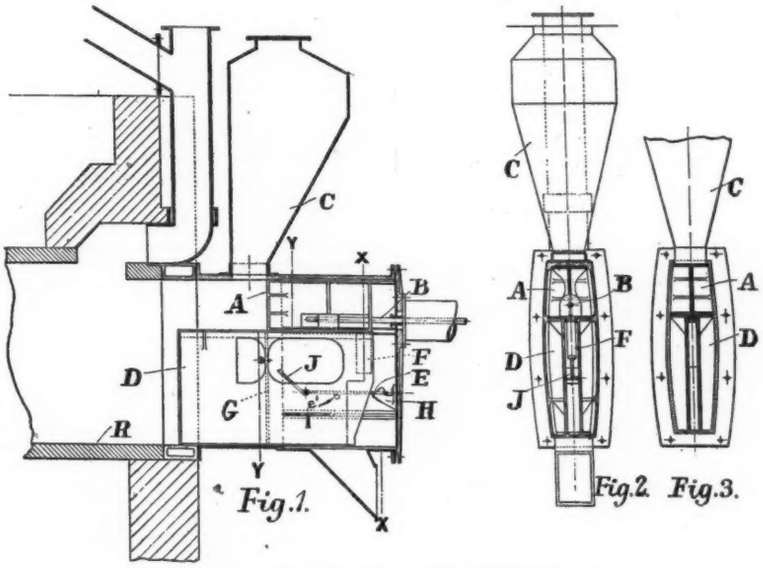


Fig.1. Fig.2. Fig.3.

West and Wild's Retort-Charging Appliances.

Thus practically a flat disc or block made up of pieces of coal is forced against the coal in the retort; so that an even pressure is applied to it. If the coal charge is merely heaped-up in front of the ram and compressed by the latter, excessive pressure is exerted at the bottom of the charge in the retort, and sets up wedging or binding,

which prevents the efficient operation of the plant. On the return stroke of the upper portion A, the lower portion D remains stationary until the upper part has traversed a pre-determined distance, when the two parts move together—due to the part F of the upper ram engaging the rear of the lower ram. Then, finally, the lower portion is locked by its catch-piece E.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for March 12.]

Nos. 5171—5832.

BECKET, W. H.—"Atmospheric burners for gas-fires." No. 5462.
BRAYSHAW FURNACES AND TOOLS, LTD.—"Apparatus for measuring flow of gas or air." No. 5529.
BUSBY, F.—"Adjustable gas-economizer." No. 5360.
COMPAGNIE ANONYME CONTINENTALE POUR LA FABRICATION DES COMPTEURS À GAZ ET AUTRES APPAREILS.—"Mechanical shovelling-devices." No. 5801.
CUTHBERTSON, R. W.—"Apparatus for quenching and transporting coke from coke-ovens." No. 5209.
CUTLER-HAMMER MANUFACTURING COMPANY.—"Control of flow of fluids." No. 5515.
DUNHAM, M. K.—"Burning combustible gases." No. 5664.
FAUCONNIER, E.—"Apparatus for domestic heating and lighting by inverted incandescence burners." No. 5629.
FOSTER, J.—"Carburettors or gas-enrichers for gas-lighting systems." No. 5473.
FRITH, J.—See Brayshaw. No. 5529.
GALLOWAYS, LTD.—"Piston for gas-engines." No. 5616.
GAY, L.—"Arrangement of plates for absorption, reaction, distillation, and rectification columns, &c." No. 5730.
GREENSMITH, T.—See Cuthbertson. No, 5209.
GUINN, S. E.—"Gas-lighters."—No. 5255.
HOBBS, J. H.—"Flexible joints for gas-pendants, &c." No. 5642.
JOHNSON, H.—"Gas-igniter." No. 5309.
MACDONALD, D. & R.—"Method of making hydrocarbon gas." No. 5814.
M'FARLANE, C. J.—"Globe and globe-holder for gas-fittings, &c." No. 5546.
PILLING, H.—See Galloways. No. 5616.
RYFFEL, F.—"Gas-condenser." No. 5397.
SIMPÈRE, A.—See Fauconnier. No. 5629.
WELLS, E. P.—"Gas-fuel container." No. 5188.
WHITE, A. E.—See Cutler-Hammer. No. 5515.

[Extracted from the "Official List" for March 19.]

Nos. 5833—6542.

APPLEBY, E. G.—"Apparatus for agitating fuel in gas-generators, &c." No. 6336.
BAPTY, S. L. H.—"Gas-burners." No. 6232.
BENTLEY, G. H.—See Appleby. No. 6336.
BOX, E. W.—"Incandescent gas lighting." No. 5963.
CLARKSON, T. J. R.—"Dry gas-meters." No. 6119.
COMINGS, W. R.—"Regulating gas-burners." No. 6285.
DAVEY, E. H. C. C.—"Valves, cocks, taps, &c." No. 6437.
DIBDIN, W. J.—"Revivifying spent oxide." No. 6523.
DORMAN & CO., W. H.—"Stopcock for high-pressure fluid systems." No. 6306.
FAIRHURST, T.—"Gas-regulators for bunsen burners." No. 6490.
FLETCHER, RUSSELL, & CO.—See Fairhurst. No. 6490.
HANAPPE, E.—"Appliance for gas-generators." No. 6328.
HANSON, J.—See Dorman. No. 6306.
HELPS, G.—"Gas-stoves, cookers, &c." No. 6176.
HELPS, G.—"Bunsen burners for cookers, &c." No. 6264.
HOOD, J. J.—"Recovery of cyanogen from coal gas." No. 6445.
KENNEDY, J. E.—"Rotary retorts, and destructive distillation of carbonaceous material therein." No. 6057.
KIMPTON, W. H.—"Atmospheric gas-burners." No. 6002.
KNOWLES, W.—"Composition for treating coal." No. 5844.
LEWIS, W. Y.—"Appliances for effecting heat transference between gases, vapours, or liquids." No. 6182.
LINDSAY LIGHT COMPANY.—"Process of purifying thorium compounds." No. 6456.
M'CANN, D.—"Torches for gas lighting." No. 5843.
M'LEOD, H. N.—"Apparatus for carbonization and distillation of moist carbonaceous materials." No. 6426.
MELLOR, L. & W. H.—"Pumps, compressors, exhausters, &c." No. 6368.
PEARSE, A. L.—See Kennedy. No. 6057.
PODMORE, A. E.—"Gas lamps or lanterns, &c." No. 6220.
RIDEAL, E. K.—"Detection and estimation of ammonia in gases." No. 5904.
RUSSELL, W.—See Fairhurst. No. 6490.
SCHROEDER, F. W.—"Incandescent gas-burners." No. 6253.
SHAKESHAFT, C. E. M.—See Clarkson. No. 6119.
SLOAN, J. D.—"Process for utilization of peat, brown coal, straw, moss, coal, cellulose, carbonaceous material, natural bitumen, and hydrocarbons either in combination or separately." No. 6135.
TARRANT, A. G.—See Rideal. No. 5904.
VAN SICKLEN COMPANY.—"Apparatus for delivering gas." No. 6335.

Assessment of the Stoke-on-Trent Gas Undertaking.—At the last meeting of the Town Council of the County Borough of Stoke-on-Trent, Mr. Alex. MacKay, the Chief Engineer and General Manager, was congratulated on the successful result of his appeal against the income-tax assessable values of the gas department. The Court had two days' hearing of the case, and all details were carried out by Mr. MacKay himself. The actual result will mean a saving of over £3000 per annum on the four works of the gas undertaking.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Stourport Gas Bill.

The opposition to the Stourport Gas Bill has been withdrawn, and the Bill has been referred to the Unopposed Bills Committee.

Sulphate of Ammonia Exports.

Viscount TEMPLETOWN asked if the Sulphate of Ammonia Export Traders' Association, who controlled the sales of sulphate of ammonia, were correct in informing applicants for permits that they could not be granted for shipments to Spain; and, if so, whether it was true, as reported, that several firms (among them Mr. G. M. Bauer, the Chairman of the Association) were offering sulphate in Spain.

Lord ERNLE, who replied, said that the export of sulphate of ammonia was restricted, and the Board of Agriculture controlled the amount that could be exported. The principle upon which they went was that they provided for all the wants of the agriculture of the United Kingdom, and whatever surplus remained had been hitherto allotted only to allied countries and to their own Dominions. At the same time, there was no doubt that the Sulphate of Ammonia Association were preparing to restart their business with Spain as soon as the surplus of sulphate allowed. The increase in sulphate production had been considerable, and the increased use of it by agriculture had been very great. The export of sulphate has been cut down most drastically during the last two or three years. He thought the explanation of Mr. Bauer, on behalf of the Sulphate of Ammonia Association, offering sulphate of ammonia in Spain, was that he was anxious to keep up the trading connection with that country.

HOUSE OF COMMONS.

Benzol Extraction from, and Inerts in, Gas.

Sir KINGSLEY WOOD asked the President of the Board of Trade whether his attention had been called to the resolution of the London County Council referring to the extraction of benzol from manufactured gas and the presence of an unreasonable amount of incombustibles; and whether he was taking any steps to improve the quality of gas supplied to London consumers.

Mr. BRIDGEMAN, who replied, said he had received a copy of the resolution referred to. He understood that the London Gas Companies were not now extracting benzol from their gas, and had not done so since the early part of the winter. But stocks of coal in the gas-works in London and throughout the country were still abnormally low; and he was advised by the Coal Controller that any general return to pre-war standards was undesirable until the coal position got easier.

Lighting Glassware Import Licences.

Mr. BRIDGEMAN, in reply to a question by Mr. Rowlands, said that no licences for the importation of lighting glassware were transferable without the express authority of the Controller of the Department of Import Restrictions. Information had been received that one concessionaire under the glassware ration proposed to sell his licences; and when he made application for the licences, suitable action would be taken to prevent the proposed sale.

Cost of the Coal Controller's Staff.

Mr. BRIDGEMAN (the Parliamentary Secretary to the Board of Trade), in reply to a question by Mr. Gilbert, said that the staff of the Coal Controller's Department numbered approximately 910, of whom 530 were in London. In addition, about 450 engineers throughout the country rendered honorary part-time assistance in connection with the campaign to secure economy of fuel in industrial works, &c. The cost of the Coal Mines Department during the financial year 1918-19 was approximately £250,000; and the estimated cost for the year 1919-20 was £517,253—the increase being due largely to the fact that payment of the claims of local authorities and gas and electricity undertakings and companies in respect of work done by them under the Household Fuel and Lighting Orders would fall mainly within the coming year.

Loss on the Marylebone National Kitchen.

Mr. RENDALL asked the Parliamentary Secretary to the Ministry of Food why the national kitchen in Maida Vale was to be closed, and whether he was aware that thousands of housekeepers had been gradually learning to economize in coal and gas as the result of the kitchen's existence.

Mr. M'CURDY replied that it was recently decided by the Marylebone Borough Council that the kitchen referred to should be closed owing to the fact that it was being run at a loss, and that the premises were again required for use as public baths. He was fully in accord with the view that national kitchens and restaurants should be continued and developed, wherever possible; and he proposed to take steps, in conjunction with the local authority, for the reopening of a national kitchen in this district in the autumn.

Group A. Bills Committee.

Group A. Bills have been referred to a Committee who will meet tomorrow at 11.30; the members being Sir Harry Samuel (Chairman), Colonel Jackson, Mr. Frederick Hall, and Mr. Lyle-Samuel. The measures to be considered by them include the Northampton Gas Bill, the Stockbridge Gas Bill, and the Bournemouth Gas and Water Bill.

The Company of Proprietors of the Grand Junction Canal have withdrawn their petition against the Northampton Gas Bill.

Last Wednesday Mr. William Emmott, aged 75, formerly a member of the Oldham Town Council, was found dead in bed. There was an escape of gas in the room.

MISCELLANEOUS NEWS.

SULPHATE OF AMMONIA ASSOCIATION.

Scheme for the Centralization of Sales.

The above-named Association have circulated among manufacturers of sulphate of ammonia a scheme which has, as its primary object, the protection of British manufacturers' interests both at home and in the export market—preliminary to making an application to the Board of Trade for a licence to commence operations on the 1st of June next. It is believed that, if makers of sulphate of ammonia decide to support the scheme, this will make a material difference to the attitude of the Government towards a continuance of the control of sales. The Committee indicate (as follows) the chief considerations which have moved the originators of the scheme to put it forward:

For the past two years all sales for export have been made by the Sulphate of Ammonia Association; practically all home orders have been dealt with by the same body acting as agents for the Ministry of Munitions and the Food Production Department; a uniform "delivered" price has been in operation in the United Kingdom, and delivery charges pooled; an effort has been made to improve the make by allowing sellers to ask a substantial premium for better quality; the speculative broker has been practically eliminated as far as the home market is concerned, and a body of more or less controlled merchants created, who sell for a fixed commission; and the difficulty of lack of storage at the works has been overcome by giving consumers security as regards prices, and thus inducing them to take delivery throughout the year at graded prices.

The practical result has, it is said, been an increase in the home consumption (apart from munitions), from 60,000 tons in 1913-14, to 238,000 tons in 1917-18. The demand for 1918-19 is approximately 250,000 tons. The present producing capacity of the United Kingdom is about 460,000 tons, of which probably at least 50,000 tons will continue to be produced in the form of concentrated liquor.

The producing capacity of the chief countries in the world is estimated to have increased to the following extent:

	1914.		1918.	
Great Britain	from 426,000 tons	to	458,000 tons	of sulphate of ammonia.
America	,, 190,000	,,	500,000	,, ,,
Germany	,, 500,000	,,	1,000,000	,, ,,
Japan	,, 16,000	,,	60,000	,, ,,
South Russia	,, 17,000	,,	30,000	,, ,,
South Africa	,, 500	,,	4,000	,, ,,
China	,, 4,000	,,	10,000	,, ,,
India	,, 1,000	,,	4,000	,, ,,
	1,154,500		2,066,000	tons of sulphate of ammonia.

Apart from this, there has been an enormous increase in the capacity for producing synthetic nitrogen in other forms in America, France, Germany, and Norway, a conservative estimate of which would probably be 500,000 tons of sulphate of ammonia equivalent; and the productivity of Chile has also been raised by improved methods of extracting nitrate of soda. The world's capacity for consuming nitrogen has, no doubt, also increased very largely. But the cry of all agricultural countries is for cheap fertilizers; and the greatly increased production of nitrogen is likely to lead to wide speculative fluctuations, and a severe fall in prices, under the stress of unrestricted competition. It follows, therefore, that it is to the interest of every individual producer of nitrogen, however small, to eliminate all avoidable competition.

If the foregoing statement is accepted as an approximately accurate description of the present position, an overwhelming case would seem to exist, the Committee point out, for centralizing sales of British sulphate of ammonia. In fact, it is safe to predict that centralization will come about immediately in one of two forms—either makers will combine to form their own Central Sales Office, or the few merchants who have hitherto dominated the export market will provide the central organization for both home and overseas sales. In the first case, the makers will fix prices to the dealers; in the second, the dealers will dictate prices to the makers. So, unless the makers keep control of the home market, the entry into this market of the dealer (as distinguished from the country merchant, who sells to the farmer) is inevitable. The British consumer has now become accustomed to a "delivered" price; and the country merchants, in general, will not be willing to bear the risk of freight charges, loss in transit, &c., and the dealer will step in. The maker would, therefore, not only depend largely on the dealer for the general level of prices, but would also have to pay a double commission on sales for deliveries within a few score miles of his works.

To make it perfectly clear that the object of the proposals is to diminish, not to increase, the responsibilities and risks of the individual maker in marketing his product, the report says: The aim is to create a Central Selling Organization owned and controlled exclusively by British makers for their own interests, which would sell at the best prices obtainable, both for home use and for export. The Central Organization would both buy and sell as a principal, and would pay for, and take delivery of, each individual maker's production in bulk at his works as produced whenever delivery instructions were required. Payment would be made in accordance with the actual quality delivered. Consequently, though the maker would find his market immediately his salt was produced, it is an integral part of the scheme that both quality and storage capacity will be taken into account in the ultimate adjustment of prices provided for by the scheme. Thus it will be to the individual advantage of each maker to turn out the best quality possible, and to provide storage accommodation for a considerable portion of his make.

It seems probable that, with good management, the home market should provide an outlet for at least half the production for many years to come; but the Central Organization will be equally well able to deal with export orders. Complete liberty of choice will be retained, as regards the method of selling for export. It may prove advantageous to make arrangements terminable at reasonably short notice with British export merchants in such manner as to identify the interests of maker and merchant, to limit the merchant's profit, and to prevent speculation. If such arrangements proved unsatisfactory, direct contact with overseas markets would be established.

The chief problem is to find means of providing a continuous outlet for those works which cannot store, without forcing sales when the market is overstocked. In the past, British makers have over and over again caused prices to fall to an extent altogether out of proportion to the real relation of production to consumption, by their inability to hold stocks even for short periods. The problem can, it is contended, be scientifically solved in two ways: (1) By fixing prices on a sliding-scale, so as to induce consumers to take delivery before the periods of actual consumption; (2) by providing storage accommodation. The Central Organization could avail itself of both these methods; and advantage would be taken as far as possible of the storage capacity of producers who would be compensated for the use of their stores beyond a fixed period. If the storage capacity of producers were found insufficient, the Central Organization would be in a position (when desirable) to make arrangements for renting or otherwise acquiring stores. The Executive would, of course, be guided by the general position in the home and export markets, when considering whether and what quantity it was desirable to store at any given time.

It is estimated that to work the scheme a loan capital of £500,000 will ultimately be required; and on the capital provided by members it is proposed to pay 7 p.ct. interest. The capital would be provided by members in proportion to their annual production. The case of municipalities and other public bodies, which are under statutory disability to provide capital, or to become members of a company, is provided for in the scheme. They would be required to make long-term contracts with the Central Organization for the sale of their whole production of sulphate of ammonia; and it is understood that there is no legal difficulty to prevent their adopting this course.

It will be the object of the Central Organization, ultimately, only to market one standard quality of sulphate of ammonia, in the most perfect mechanical condition, under a distinctive brand. The experience of the past few years has shown that the question of quality depends almost entirely on the possibility of eliminating the free acid in the sulphate of ammonia; and it has also been found, by experiment, that the free acid can be eliminated by simple and inexpensive means—either during the process of manufacture or after the sulphate has been produced. While each producer should, therefore, himself make his product conform to the best standard quality, it is recognized that some makers might find difficulty in so doing. It might, accordingly, be desirable and economical for the Central Organization to provide any stores rented (either at ports of shipment or in agricultural districts) with the best plant available, in order to treat sulphate which was not up to standard. Makers already producing neutral quality would be given a special allowance to countervail their contribution to the cost of treating the other salt in such stores.

The Central Organization will have a thoroughly democratic constitution—providing for the adequate representation of all interests on a Grand Council consisting of elected members who must all be (or represent) actual producers. From the members of this Council there will each year be elected a small Executive Committee, a majority of whom shall be representatives of makers providing the capital. The Executive Committee will appoint a manager to carry-out the policy determined by the Executive. The Grand Council would meet three or four times a year, and the Executive once a month, or oftener if required. The head office of the organization will be in London, and housed independently of any individual producer. In case of need, branch offices would be set up at suitable centres in the country; and these would have definite zones allotted to them with a view to facilitating the issue of forwarding instructions to works in these zones. The branch offices would invoice and collect payments for all home sales in the zones, and would also act as centres of propaganda. General questions of allocation, distribution, and all matters connected with export would, of course, be dealt with by the head office. In arranging for branch offices, the existing country offices of the Sulphate of Ammonia Association in Scotland, Lancashire, and Ireland would be utilized; and it is thought that considerable economies may be effected by making arrangements with existing organizations—such as the Scottish Oil Agency, the North Eastern Bye-Products Association, the Cumberland Sulphate of Ammonia Makers Association, &c.

The scheme involves the pooling of prices, with special allowances to individual producers for quality and storage capacity. The scale of such allowances would be open to revision from time to time by the Grand Council after consultation, if necessary, with *ad hoc* local committees of producers. Seeing that many producers have created a market for themselves among local farmers, they would be credited with an allowance to be determined by the Executive in respect of any farmers' cash orders received by the Corporation through the maker. In the case of sales to local farmers, when desired by the maker, he would be permitted to collect payment from the buyer, subject to his accounting to the Central Organization for the sale.

The success and influence of the Central Organization will depend largely on the amount of tonnage participating. It is not proposed to commence operations until makers representing at least 250,000 tons per annum have agreed to join the scheme; but its originators hope for a membership representing fully 380,000 tons. If the organization controls such a tonnage, there should be little difficulty in maintaining a steady remunerative price for sulphate of ammonia at home; and, in view of the increase in the production of nitrogen in the world, already stated, it is likely that the home market will prove the most profitable, as well as the most natural, outlet for British sulphate of ammonia.

While the object will be to obtain the maximum price which the farmer can afford to pay, no attempt will be made to maintain prices at an artificially high level; for it is obvious that any such attempt would provide an opportunity for overseas producers of nitrogen to invade and capture our market. As regards the export market, it is obvious that one strong organization controlling a large tonnage will

have a far greater range of action than a number of individual producers or merchants in competition one with another; and it is hoped that it may be possible to make arrangements with overseas groups of producers of nitrogen, with a view to avoiding unnecessary competition in the export markets also.

The following is the scheme for co-ordinating and extending the activities of the existing Sulphate of Ammonia Association:

A. A licence to be obtained from the Board of Trade to register the "British Sulphate of Ammonia Corporation, Ltd." (referred to hereunder as the "Corporation") as a corporation formed not for profit, but for promoting commerce.

B. The Corporation would thus be constituted a legal entity which could make and enter into contracts and enforce them, which the present Association cannot do. By this means the Corporation would control the sale of the product in the interest of producers of sulphate of ammonia, but would itself make no profit. The liability of producers who became members of the Corporation would be entirely limited to an amount [which would be nominal] to be fixed by the articles, which sum would be called up only on a winding-up to answer debts or obligations, if any, then existing.

C. The capital required would be provided by members in proportion to their production. The capital so provided would, if required, be refunded on a member retiring from the Corporation or on a winding-up thereof.

D. The Corporation would co-operate with the Sulphate of Ammonia Association in carrying out the propaganda work hitherto done by the Association; but the Association would, in case of need, retain its separate identity as a propaganda body,

E. The Corporation would enter into contracts firstly with all producers who became members, and membership would be open to all producers in the United Kingdom; and, secondly, with those producers who, in order to obtain the advantages of the combination, desire to make contracts with the Corporation, but who for legal reasons are unable to become members—*i.e.*, such bodies as municipalities. The main features of the contract would be:

(1) That the Corporation buys from the contractors their whole production of sulphate of ammonia, to be delivered as called for by the Corporation, for a period of ten years, such ten years to run from the date of incorporation. Sellers entering into contracts co-incident in date with the incorporation to have the option of determining the contract on giving six months' previous notice to expire at the end of the Corporation's second financial year. But if such notice be not given, such sellers to have the option of determining the contract by giving one year's previous notice to expire at the end of the Corporation's sixth financial year. Provision would be made for notice being given by sellers entering into contracts not co-incident with the date of incorporation, enabling them to terminate their contracts on corresponding lines. It would be open to the Executive of the Corporation to shorten the contract term if authorized so to do by a majority of two-thirds of the votes of the members of the Corporation—voting to be by tonnage. The Corporation to guarantee to remove each contractor's production from his works in such manner as to enable the contractor to produce continuously.

(2) That contractors are not to sell or buy sulphate of ammonia independently of the Corporation or through other persons or companies.

(3) That contractors are bound, not later than a fixed date in each month, to give to the Executive of the Corporation such information regarding their output as the Executive shall demand.

(4) That if from causes other than strikes, lockouts, fire, act of God, *force majeure*, or other causes beyond the control of the contractor he fails to deliver to the Corporation the quantity notified if called for, and thereby the Corporation incurs a loss through having entered into forward contracts on the basis of figures given and being unable to comply with these contracts, the losses as ascertained shall be charged against the particular producer, and debited to him in the account which the Corporation will ultimately deliver to each producer.

(5) That payment will be made for all sulphate of ammonia delivered on a certain day in each month following the despatch of the product.

(6) That the amount so to be paid shall be an interim price fixed by the Executive (who will be representative of the producers) for periods of not more than three months, and not less than one month, ahead.

(7) At the end of every three months, an account shall be made up of all sulphate of ammonia purchased and sold by the Corporation; and each contractor shall have his account adjusted on the basis of the total price realized and the total price paid including costs incurred and all the management and other expenses of the Corporation, and 7 p.ct. on the capital—*i.e.*, if the prices realized have exceeded the total prices paid, each contractor will receive a proportion of the excess price relative to the total quantity he has delivered to the Corporation during the period as compared with other contractors, and subject to special adjustments for quality and storage capacity to be fixed from time to time by the Executive of the Corporation. On the other hand, if the Corporation has made a loss, this loss will be borne in proportion to the deliveries by each contractor; and his share of the loss will be deducted from the next monthly payment due to him. But the Executive shall be empowered to defer final settlement to the end of every six months during the first two years' working of the Corporation. Any sums representing adjustments so withheld shall be placed on deposit with approved bankers, or invested in trustee securities in the discretion of the Executive, and the interest brought into account in the final settlement.

(8) The Corporation shall make all contracts with contractors f.o.r., or free into barge, at makers' works.

(9) Quantities delivered by contractors to the Corporation's stores, or kept in stock by contractors at the request of the Corporation, will be paid for at the interim price, and (when the periodic final adjustment is made) will be brought into account for the purpose of participation in the excess price realized on sales over the interim price as provided by Clause E (7).

(10) Each contractor to the Corporation will be required to comply with such conditions as to the storage capacity to be provided, and the standard of quality to be manufactured, as shall be determined from time to time by the Executive. In view of the altered conditions in the sulphate of ammonia market, each contractor would require to be in a position to store a minimum of eight weeks' production. In the event of contractors finding difficulty in complying with the requirements of the Executive as regards storage capacity and quality, the Executive will consider special cases on their merits.

GAS COMPANIES' PROTECTION ASSOCIATION.

Alteration of Rules.

A Meeting of the Association was held at Caxton Hall, Westminster, last Thursday afternoon, to consider, and, if approved, to adopt some proposed new rules. The chair was occupied by Mr. H. E. JONES.

At a meeting of the Committee last July, it was unanimously agreed to appoint a Sub-Committee to consider: (*a*) The constitution of the Association; (*b*) the objects of the Association; (*c*) the relations of the Association with, and to, other bodies; and generally such provisions as might be desirable for adoption to bring the Association into line with the present and anticipated future requirements of the gas industry—particularly as affecting statutory and non-statutory undertakings owned by companies. As the result of their deliberations, the Sub-Committee, under the chairmanship of Mr. R. Bruce Anderson, arrived at a number of decisions, upon which the new rules submitted to the members at Thursday's meeting were based. The principal alterations were outlined by Mr. R. W. Edwards in the course of his remarks.

The SECRETARY (Mr. Fred. E. Cooper) having read the notice convening the meeting,

The CHAIRMAN pointed out that the business was purely formal. The new rules were, of course, to enlarge as far as possible the scope of the Association. No doubt, they were all familiar with the rules; and he would therefore formally move that they be received and adopted.

Mr. R. BRUCE ANDERSON (London) seconded.

TWO POINTS OF OUTSTANDING IMPORTANCE.

Mr. R. W. EDWARDS (Aldershot) said he had met with evidence of some little misapprehension on one or two points—particularly on the question of subscriptions. There was no intention whatever of altering the scale of subscriptions, which remained as before. There were in the new rules two points of outstanding importance. Rule No. 4 read:

> "The Association may be federated with other bodies, conditionally only that the complete independence of the Association be preserved."

They had been federated or associated with the National Gas Council since its commencement; but it was felt, in going into the subject of the alteration of rules, that this point ought to be put beyond doubt. It was necessary that subscribers should realize that, while they desired to associate with the Natioual Gas Council or with any other body who were assisting the gas industry, they would nevertheless preserve their independence.

The CHAIRMAN said this was very important; and he would be one of the last to do anything to prevent the independence and the individual energy and action of separate bodies being fully exercised. They must all do their best in their own way, and then come together and fortify each other.

Mr. EDWARDS (continuing) said that when the matter was referred to the Sub-Committee they gave careful consideration to it. They realized that in days to come the usefulness of the Association would be more pronounced that in the past. The gas industry was face to face with most serious circumstances, which could never have been anticipated. They would require all the enterprise, care, and caution possible to steer the industry into calm waters again. There were grave problems to solve; and not the least of them was the adjustment of the financial affairs of the companies. The Financial Relief Act was but a small sop, and one which they did not regard in any other light than as a temporary measure—and not a very grateful one from the country, having regard to all the gas undertakings had done. It was felt that this question must come shortly to the front, and that the Association must play a very prominent part in connection with it. The next important point was Rule No. 16:

> "The Committee shall meet not less than twice a year. They shall at their first meeting after each annual general meeting appoint an Executive Committee—consisting of the Chairman, Vice-Chairman, and three members—by whom questions of urgency shall be dealt with. They may from time to time appoint a Sub-Committee or Sub-Committees for any special purpose or purposes, and may delegate to them all or any of the duties which would otherwise be performed by the Committee."

It was realized that the members were scattered all over the United Kingdom; and it was not wise to be always calling the Committee together on every little question. Therefore it was imperative, in the interests of the industry and of the Association, that there should be an Executive Committee who would be available to advise the Secretary, and deal with matters day by day, without having them hung-up until such time as a Committee meeting could be called. Generally speaking, the idea had been, not so much to demolish any part of the Gas Companies' Protection Association, as to strengthen those parts which were thought to be somewhat weak, and thus to prepare it for doing still more good for the industry than it had done in the past. The Association had already done tremendous work; and it was just because of this that the Committee felt it could do even more in the future. He had pleasure in supporting the motion.

Mr. C. F. BOTLEY (Hastings) remarked that it needed to be clearly understood in the industry that, however united they might desire to be, there were matters on which they could not have absolute unity; and it was essential that there should be a body which could speak particularly on behalf of the investors in gas companies. As to the proposal for an Executive Committee, they could not expect to have their Chairman at their beck and call every minute. Mr. Jones had rendered wonderful service to the industry and the Association; but matters were going to crop-up so frequently that a small Executive Committee was desirable to promptly attend to them. They must have independence in some respects, and must also try to make the Association very live indeed, by giving devoted service to its interests.

The CHAIRMAN said he was in absolute agreement with the necessity for a small Committee, in the extraordinary circumstances. A thing which had impressed him very much, both in connection with the Association and the National Gas Council, was the extraordinary amount of devotion with which gentlemen had when necessary come from all parts of the country. It would be simpler to have an Executive Committee possessing the full confidence of the members, with power to act at once.

The resolution was then unanimously agreed to.

THE CHAIRMAN'S PENDING RETIREMENT.

The CHAIRMAN said he could not himself undertake to head the Committee of the Association very much longer. The extra cares and duties of the years of the war had had double effect upon the energy and vitality which he formerly possessed. Of course, he was not going to take leave of them at once; but they must prepare themselves for getting another Chairman. He would like to see the chair of the Association (which was many years ago dignified and ornamented by the presence of the late Sir George Livesey) filled by someone who would keep them in the van, and speak authoritatively to Parliamentary Committees and other bodies. The unanimity of the present meeting had greatly pleased him.

Mr. EDWARDS, proposing a hearty vote of thanks to Mr. Jones for presiding, said they could not let the meeting close until they had paid a tribute to the Chairman, who had just referred to the possibility of his retirement from the chair at an early date. Those who had worked with Mr. Jones appreciated to the full his valuable services. He stood pre-eminent as the man who had the longest experience of the gas industry to-day; and the members would learn with extreme regret of his pending retirement from the chair. When the time did arrive, they sincerely hoped he would not retire from the Committee, but would retain his seat, and continue as far as he could to give them the advice which they so highly prized.

The CHAIRMAN: That I shall always do.

A PERMANENT OR CHANGING COMMITTEE.

Mr. H. E. BLOOR (York), seconding the proposal, said that, speaking as a private member, he was rather sorry to see so small an attendance, and would like to find those belonging to it taking a more active part in the work. He pointed to a suggestion he made some two or three years ago, that it might perhaps help to bring members into closer contact with the Association if membership of the Committee were not made permanent—if there were a system of rotation, with retiring members not eligible for re-election for (say) twelve months.

Mr. T. H. HAZELL (Newport) supported the vote, and said there was a reason for the small attendance. It was not expected that members would turn up in full strength to approve of rules. If there had been anything like objection to them, it would have been different; but seeing that proxies were sent out (which of itself constituted a suggestion that it was not necessary for members to attend), they availed themselves of the opportunity to send their votes along.

Mr. EDWARDS: We have here nearly thirty proxies from gas companies, most of them fairly large.

The vote was cordially passed; and the CHAIRMAN, in acknowledgment, alluding to Mr. Bloor's suggestion for changing the membership of the Committee, remarked that there was something to be said for continuity of policy.

LEA BRIDGE DISTRICT GAS COMPANY.

The Half-Yearly Meeting of the Company was held on Tuesday last, at the London Offices, Nos. 63 & 64, Chancery Lane. W.C.—Mr. A. M. PADDON (the Chairman) presiding.

The SECRETARY (Mr. Richard Sandell) read the notice convening the meeting; and the report and accounts were taken as read.

ACCOUNTS OF AN EXCEPTIONAL CHARACTER.

The CHAIRMAN said there were two statements in the report which gave the accounts an altogether exceptional character. The first was that they had had an increase in business of a very considerable kind—over 6 million c.ft.—at a time when there was hardly an instance of such an increase in the companies round about or in undertakings generally throughout the kingdom. Though their Company incurred the full effect of the restrictions, the impetus on the business was of such an exceptional kind that they had this increase to record. The second statement was that a dividend of 6½ p.ct. was recommended; and as to this, he believed they were almost the only Company in the Suburban and Metropolitan series who had succeeded in maintaining throughout the whole prriod of the war, without any variation, the same dividend that they paid before. This was certainly a matter for congratulation. The accounts showed that for the purposes of the business they employed capital at the rate of £469 per million c.ft. of gas made; and this was the substratum upon which such excellence as they could boast was based. With an initial figure of this kind, one knew that there existed the most favourable atmosphere possible in which to carry on the undertaking. The selling price of gas for the period under review was 3s. 6d. per 1000 c.ft.; and this was a figure which in itself spoke volumes in favour of the Company. That, in these days of stress and exaction, and difficulty and exigency, they should have been able to base such a statement of profit upon a selling price of 3s. 6d. was no small achievement. They knew the prices charged by the big Metropolitan Companies and the Suburban Companies all round London; and their own was the lowest of any of them, with one single exception, and to this they approximated very closely. Sales of gas had brought in £4561 more, and residuals some £600 less; the total additional credit being £3926. Coal cost on an average some 33s. per ton; and this was a useful figure to remark in these times, when the future price of this essential commodity was so very doubtful, and he might say almost threatening. Another interesting figure was that of wages for carbonizing. These worked out to 3¾d. per 1000 c.ft., including all the advances imposed upon the Company by the prevailing conditions; and having regard to all the circumstances, this was a very satisfactory figure. For repairs and maintenance of works there had been allowed over 7d. per 1000 c.ft.; and the total charges for repairs and maintenance amounted to between 13d. and 14d. per 1000 c.ft. This was a figure which would have required some explanation in the olden days, but which was necessary now owing to the lower purchasing power of money. In some charges they might expect an improvement. Insurances were £126 less, and they hoped would grow yet smaller; and there was a substantial decrease in payments to dependants of men on service, which were nearly £500 less than a year ago, and would gradually disappear.

THE HALF-YEAR'S RESULT.

The epitome of it all was that the expenditure was £4736 more, and the profit £810 less, than a year ago. But 1d. per 1000 c.ft. in this account was equivalent to £1255; so that had they charged the repairs and maintenance of works at only 6d. per 1000 c.ft., it would have wiped-out this deficit twice over. Coming to the profit and loss account, they required just over £10,000 for the distributions to be made; but he would draw their attention to the fact that income-tax was responsible for nearly £4000 of this. The dividend only needed £5614, and with the charge for debentures would amonnt to little more than £6000. On the credit side, they had earned within a few pounds of £9000; and there was available £9123. This, as he had said, left them with a nominal deficit of something like ¾d. per 1000 c ft., which had been entirely credited to the liberal apportionment that had been deliberately made in order that the Company might go forward in the highest state of efficiency to meet the new demands that would be made upon it. As to the current half year, there was still a satisfactory increase in business. Regarding the troubles which were general, they would not evade them in the future to the extent that they had done in the past. In other words, those dependent upon rail-borne coal would, he thought, be called upon to face a bigger burden than they had hitherto done. The position with reference to oil had already improved to the extent of 50 p.ct.; while as to the demands of labour, he could not help thinking that the gas industry had already assumed nearly as much as they could support or the Government would be disposed to lay upon them. There was, however, one direction in which they had not approached finality, and that was in the development and improvement of a business which was essentially economical, and which he firmly believed could yet develop economies in the discharge of its duties; and if any works could do this, they could do it at Lea Bridge. With their technical staff and their Engineer, he felt confident that they would see in their accounts an improvement sufficient to be a set-off against what further exactions the next few years might have in store for them. He concluded by moving the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Mr. G. W. Carey) seconded the motion, which was carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. J. M. MILES, dividends were declared, less income-tax, at the rates per annum of 5 p.ct. on the preference stock and 6½ p.ct. on the ordinary stock.

Thereafter Mr. Paddon was re-elected a Director, on the motion of Mr. CAREY; and the retiring Auditor (Mr. Thomas Maskall) was also re-appointed.

Mr. E. L. BURTON proposed, Mr. JOHNSON seconded, and it was agreed, that the remuneration of the Directors be increased by £100 each half year, as from Jan. 1 last.

A hearty vote of thanks having been passed to the Chairman and Directors,

The CHAIRMAN proposed a similar vote to the officers. He remarked that the Engineer and General Manager (Mr. F. W. Cross) had now a very anxious time in front of him. He had had to adjust his works continually throughout the war; and now he had largely to re-construct, re-model, and re-adapt them. In this, he would have the earnest support and complete confidence of the Directors.

Mr. A. F. PHILLIPS seconded the vote, which was cordially passed, and acknowledged by Mr. SANDELL and Mr. CROSS.

Dividend Maintained at Waterford.—The Waterford Gas Company has declared an interim dividend at the rate of 5 p.ct. per annum, carrying forward £3150. A year ago, the dividend was the same, £1000 was placed to reserve, and £2203 carried forward.

Alteration in Price at Luton.—To the Luton Town Council, the Clerk reported that the Gas Company had decided to abandon their proposal to increase from 3s. to 3s. 10d. per 1000 c.ft. the price for gas supplied during the quarter ending March 31, and instead to increase the price to 4s. from April 1.

Tamworth Gas Light and Coke Company.—At the annual meeting of the Company, the Chairman (Dr. A. M. Sculthorpe) said the Directors had passed through a very anxious year, owing to the difficulty of obtaining coal supplies. If the price of coal was increased by the amount suggested, he did not see how they would be able to carry on their works unless they further raised the charges for gas. It was decided to declare the usual dividend of 20s. on each old share, and 14s. on each new share, less income-tax. Mr. W. A. Sapey, the Manager, said if coal went up anything like 8s. or 10s. a ton he did not know, unless something unforeseen occurred, how they would be able to carry on. He mentioned that the rationing of gas in their area had reduced the consumption by 10 p.ct.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

Half-Yearly Report.

The report of the Directors of the Company for the half year ended Dec. 31, to be presented to the shareholders on Thursday of this week, stated that the accounts show a profit on revenue account of £32,032; and, after providing for interest on the debenture stock and temporary loans, there remains a sum of £23,279, to which must be added the balance brought from the last account and a credit from the income-tax account, making a total of £40,269. In the last report, it was explained that application had been made to the Board of Trade for a Provisional Order under the Statutory Undertakings (Temporary Increase of Charges) Act, to permit the Company to pay a £3 6s. 3d. p.ct. dividend, in lieu of the maximum statutory dividend of £2 17s. 6d. p.ct. The Directors regret that, up to the present no Order has been made by the Board of Trade, who have withheld dealing with the application pending the receipt for their consideration of the accounts now submitted. These accounts have been furnished; and the Directors trust the Order asked for will be made, and that they will be able to adjust and pay the difference on the next occasion. In the event of the larger dividend being sanctioned, a sum of £25,702 will be absorbed; while, at £2 17s. 6d. p.ct. per annum, the amount will be £22,308—leaving, in the former case, £14,566 to be carried to the next account, or a balance of £17,961 in the latter.

The gas made was 803,486,000 c.ft., including 260,484,000 c.ft. of carburetted water gas. The gas sold included 8,731,000 c.ft. for public lighting; and for private lights, per meter, 674,836,000 c.ft, —making a total of 683,567,000 c.ft. With the gas used at the works, 17,359,000 c.ft., the total quantity accounted for was 700,926,000 c.ft. Gas unaccounted for totalled 102,560,000 c.ft. The number of public lights is given at 2845.

PRIMITIVA GAS COMPANY OF BUENOS AYRES.

A Heavy Loss.

A circular has been sent out to the shareholders of the Company announcing that the Chairman (Mr. A. E. Bowen) has arranged to sail for Buenos Ayres at the end of this month; and he wishes to meet the shareholders to-day, in order to put before them such particulars of the year's working as are available. The accounts are on the way, and are expected daily; but it is unlikely that they will arrive in time for audit, so as to be in the hands of the shareholders before the meeting. If they should arrive within the next few days, every effort will be made to post the balance-sheet and the profit and loss account to the shareholders so as to be in their possession prior to the meeting. Should the date of posting leave the shareholders insufficient time to study them prior to the meeting, it is proposed to adjourn the meeting.

The year's working has been communicated by cablegram; and the approximate results show a total loss at Dec. 31, 1918, of £131,895. It has been impossible to arrive at any settlement with the Municipality, who owed the Company £135,693 on Dec. 31, when the Company closed-down the public lighting, except to the hospitals.

After the above notice was sent out to the shareholders, the accounts of the Company for the year ended Dec. 31 last were received from Buenos Ayres; and in submitting them, the Directors report as follows:

The figures of the profit and loss account as given in the first notice are substantially correct, the audited figures being:

Loss on year's working in Buenos Ayres					£50,836	11 5
Add:						
Debenture interest	£64,224	4	4			
Sinking funds—"River Plate" and "Buenos Ayres (New)" debenture stocks	7,978	2	5			
Bankers' remuneration for service of first debentures	150	0	0			
Pension fund (balance)	429	0	1			
London office expenses, fees of Directors and Trustees for the debenture holders, salaries, depreciation of office furniture, &c.	10,792	12	6			
				83,573	19	4
				£134,410	10	9
Deduct:						
Receipts from various sources, and relief of income-tax				31,945	6	7
Showing loss on year's working				£102,465	4	2
To which must be added debit balance of profit and loss account at Dec. 31, 1917				26,135	18	10
Making a total loss at Dec. 31, 1918				£128,601	3	0

Gas coals having been unobtainable except with the greatest difficulty and at an exorbitant price, only 11,731 tons were used. We have been obliged to turn to any available substitutes, and have carbonized 107,730 tons of timber, 26,758 tons of cereals, 3368 tons of bones, and 3325 tons of water-gas oil and crude petroleum—a total of 152,912 tons, as against 158.991 tons in 1917. But the increased cost of fuel was no less than £97,073 over that of the previous year.

Nottingham Gas Department and the Coal Strike.—The effect of the local coal strike was seen in Nottingham last week, when queues of people waited for hours outside the gas-works for coke. The Notts Miners' Association themselves were without coal for their offices. The Town Clerk issued an appeal to the public to economize in the use of gas and electric light, so as to save coal.

WAR-TIME WORK AT EDMONTON.

Activities of Messrs. Thomas Glover & Co., Ltd.

An account has appeared in the "Tottenham Herald" of the change-over to a large extent on the outbreak of hostilities from the business of making gas-meters to that of turning out munitions of war, of the Edmonton factory of Messrs. Thomas Glover & Co., Ltd.

Work in connection with aeroplane making was started about two years ago; and the first Bristol bombing machine was fitted up at the factory. The work carried out included the making of tanks, radiators, radiator shutters, cowling for aeroplanes, and also flares and bombs, as well as spirometers—a medical instrument for testing the soundness and capacity of airmen's lungs. In addition, the firm received from the Admiralty a special order for connections and pipes, &c., used for filling airships. The record of making various gun parts forms a chapter of its own. The parts made included breech blocks, breech screws, breech mechanism throughout, triggers, levers, strikers, extractors, carriers, percussion firing gear, as well as the repair of unserviceable gun parts. Millions of grenades were turned out; and these included the hand grenade, those used for signalling, and also the gas types. The French hand grenade was made here quite early in the war. The resources of the firm enabled them to turn out hundreds of trench heating stoves, made of sheet iron, constructed on novel lines, and capable of consuming anything that would burn. Likewise the firm found the work of making stoves for field and canteen kitchens something peculiarly to their liking; and army mess tins and water bottles were manufactured in thousands. While private orders for gas-meters were accumulating, the firm were ordered to make large gas-meters for Government and munition works. The canteens of many hospitals were fitted-up.

The shell used for the Stokes gun was made here complete, except the loading. Other work for the Admiralty included the making of detonators, detonator boxes, gun-cotton, and depth charge cylinders, which were employed in combating the submarine campaign. A highly skilled work the firm were specially selected to undertake was the making of gauges for testing the sizes of any gun part.

Now peace time work is being resumed; and an innovation is the manufacture of an apparatus for the speedy building of houses in concrete. In this connection, the firm are likely to play a large part, not only in England, where there is a crying demand for houses, but in devastated Belgium and Northern France. The war has claimed its toll of victims from the management, as Captain Richard B. G. Glover was killed early in the war. Lieutenant-Colonel Wm. Glover, C.M.G., D.S.O., who has also been mentioned in despatches, was recently appointed Joint Managing Director. A detached post of the "N" Division Special Constabulary at the works had at one time 220 members, under Assistant Commander Thomas Glover and Inspector A. J. Crichton. A motor ambulance was run by the works specials; and during air-raids there were at the works "breakdown" lorries and the ambulance with their brigade constantly in readiness to render help anywhere it was required. The page of war, says our contemporary, is closing; but the Directors, staff, and workpeople at the works will be able to look back with pride upon the achievements of the four years—achievements not only of industry and the workman's cunning, but a record of patriotic loyalty between employer and employed, immunity from accident, and the fact that the serving man has never been forgotten.

THE UNION OF GAS-STOVE FIRMS.

Following upon the article which appeared in last Tuesday's "Journal," publication may be given to a reference in the "Birmingham Post" to the union that has been arranged of the John Wright and Eagle Range Company, Ltd., the Richmond Gas Stove and Meter Company, Ltd., and the Davis Gas-Stove Company, Ltd. The "Birmingham Post" says:

We are able to-day to give particulars of a fusion of the leading interests in yet another important industry, designed to increase its efficiency, by standardizing and cheapening production—thus enabling it the better to meet the difficulties of the present situation. This latest amalgamation is of the leading gas-stove manufacturers of the country. The Companies concerned are: The John Wright and Eagle Range, of Birmingham; the Richmond Gas-Stove and Meter Company, of Warrington; and the Davis Gas-Stove Company, of London.

The total amount of authorized capital involved is £1,360,000 (£864,040 issued), apportioned as follows:

	Authorized.		Issued.
Wright and Eagle Range	£750,000	..	£429,040
Richmond Company	460,000	..	310,000
Davis Company	150,000	..	125,000
	£1,360,000	..	£864,040

The reasons for the fusion are explained in a circular which has been issued to the shareholders of John Wright and Eagle Range. "For some considerable time past," the Secretary states, "your Directors have felt that if a union of interests among some of the principal gas-stove makers could be arranged, it would be greatly in the interests of the shareholders and of the industry. Protracted negotiations have taken place; and I am pleased to be able to report that the Board have now completed certain arrangements in this direction which they are satisfied are greatly to the advantage of those interests. In view of the difficulties that are ahead for all manufacturing concerns, it is believed that this union of interests will enable the Companies concerned to carry on their manufacture on more economical lines, by means of a reduction in the great competitive expenses entailed in this trade, concentration of energy, saving of duplication in the heavy manufacturing expenses involved in producing the type of goods made by the interested Companies, mass production with greater output, and standardization of parts with a view to lower

production costs, and also as a means of checking rises in selling prices. It is anticipated that these arrangements will result, not in increasing the amount of the distributions on the shares so much as in a consolidating of the industry in the interests both of the manufacturers and of the purchasers of their products. It will be quite appreciated that the report and balance-sheet for the year 1918 cannot be issued at the usual time; and particulars of the arrangements made will be placed before the shareholders as soon as the Directors are in a position to do so."

Details of the scheme have not yet been completed; but we understand it amounts virtually to an amalgamation of the three Companies, and the Treasury's consent to the scheme has been asked and obtained.

All three Companies have highly successful records. John Wright & Co. was formed in 1890 to take over the business of gas engineers of a firm of that name; and ten years later the business of the Eagle Range and Gas-Stove Company was absorbed, and the present title of the Company adopted. The authorized capital is £750,000, of which £85,000 has been issued in 6 p.ct. cumulative preference shares of £5 each, and £344,040 in ordinary shares of £1 each. In July, 1902, a bonus dividend of 10s. per share was paid in ordinary shares; and in 1916 128,640 ordinary shares were issued as a bonus in the proportion of three new shares for every five old shares. For each of the sixteen years to 1915 20 p.ct. free of income-tax was paid on the ordinary shares; for 1916, 3s. 0¾d. per share was paid, together with a share bonus of 60 p ct., free of tax; for 1917, 12½ p.ct. was paid on the capital as it now stands; and a final dividend just declared brings the payment for 1918 up to 12½ p.ct.

The Richmond Gas Stove and Meter Company's authorized capital amounts to £460,000; £110,000 being in 6 p.ct. cumulative preference shares of £5 each, and £350,000 in ordinary shares of £1 each. All the preference and £200,000 of ordinary shares have been subscribed and called-up, including 100,000 ordinary shares issued in 1918 fully-paid as a bonus in the proportion of one new share for each old share. There is also some 4 p.ct. mortgage debenture stock. For each of the four years to 1911, 10 p.ct. was paid; for each of the next five years, 12½ p.ct.; and for 1917, 15 p.ct.

The authorized capital of the Davis Gas-Stove Company is £150,000 in £5 shares—half being 5½ p.ct. cumulative preference and half ordinary; and £62,500 of each class has been subscribed and paid-up. At Dec. 31, 1917, there were loans for about £52,000. For 1908, the ordinary shares received 5 p.ct.; for 1909, 1910, and 1911, 7½ p.ct. per annum; and for each of the six years to 1917, 10 p.ct. per annum.

The Rochdale Corporation, as the result of recent negotiations, have practically come to terms with the Lancashire Electric Power Company for a bulk supply of electricity from their power station at Radcliffe.

EDINBURGH GAS-WORKERS' HOURS.

In these days, when the question of manual workers' hours is engaging so much attention (and causing not a little worry to gas engineers among others), the following particulars concerning the hours of the workmen employed by the Edinburgh and Leith Gas Commissioners will have more than local interest.

In the early part of January, the Engineer (Mr. Alexander Masterton) reported to his Commissioners that the engineers and blacksmiths at the gas-works had requested a 47-hour week. The question was deferred pending the result of the deliberations of the National Gas Council (which body decided that each gas undertaking should make the best arrangements it could with its own men), and was further delayed by claims of other sections of workers, and the desire of the Commissioners to get all the men on a uniform basis of hours. At a meeting of the Works Committee on the 10th inst., Mr. Masterton stated that the delay had created considerable discontent; and he submitted a number of letters in support of his statement. On the 25th ult., the General Secretary of the Associated Blacksmiths' and Ironworkers' Society intimated that he had been instructed by members of the Society employed by the Commissioners to direct attention to the introduction of the 47-hour week in the engineering trades generally, and to request the Commissioners to give effect to these hours also. He pointed out that the new system had been in force in other industries since Jan. 6, and he claimed that the men on whose behalf he wrote should be paid at overtime rates on all hours worked beyond the 47 hours per week since that date.

On the 4th inst. the District Delegate of the Amalgamated Society of Engineers (after an interview with Mr. Masterton) wrote that he was disappointed that, after a lapse of two months, the question of a 47-hour week was still unsettled. He could not agree that the working hours and conditions of the members of his Society should be settled by a Union whose interests were not identical, or at a conference where his Society was not represented. "As I pointed out this morning," he continued, "our members in the Granton Gas-Works have been working for two months at a rate of pay lower than the district rate, and for four hours longer every week. I have therefore to claim that, pending the settlement of our claim for a 47-hour week, our members in your employment should be raised to the district rate, 1s. 5$\frac{5}{16}$d. per hour, *plus* 12½ p.ct. and overtime rates—namely, time-and-half paid for all hours over 47 hours per week worked. I have further to claim that this rate be paid as from the 2nd of January, when it became operative in the district."

The Secretary of the United Journeymen Brassfounders and Fitters Association also complained that no change had been made in the hours of the brassworkers, and intimated that these men will require to be paid for time worked above 47 hours per week as from the first week in January. At about this time, the general employees, through

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the National Union of Corporation Workers, put forward a claim for a 44-hour week; and at a conference between representatives of the Commissioners and of the Union an offer of a 48-hour week was made but not accepted.

On the 8th inst. a deputation representing the bricklayers, painters, joiners, &c., waited upon Mr. Masterton, and informed him that an agreement had been reached between the masters and men to bring into force, as from the 10th inst., a working week of 44 hours; that the question of the pay the men were to receive for the reduced week was still under discussion; and that endeavours were being made to fix it at 50 hours—that is, they were to receive 50 hours' pay for 44 hours' work. Two days later the men sent in a formal application for a 44-hour week. They stated that the Master Builders' Federation and the various Unions of the Building Trades had, before the Committee on Production, come to an agreement for a week of 44 hours; and that, according to the rules of their Unions, they must fall in with the National decision, or drastic action would be taken with them.

The Works Committee authorized Mr. Masterton to inform the bricklayers, and other tradesmen attached to the building trades, that their weekly working hours would now be 44, and that a week of 47 hours would be granted to the engineers, blacksmiths, and brass-workers. The question of pay had still to be settled; but it would be retrospective, in the case of bricklayers, &c., from the 10th inst., and in that of the engineers, &c., from Jan. 2. They also appointed a Sub-Committee, with powers, to adjust the remuneration of these men in relation to the new hours.

On Wednesday last representatives of the Commissioners and of the Edinburgh and Leith Corporations and representatives of the National Union of Corporation Workers conferred on the questions of an increased bonus and the working hours; and it was agreed to increase the bonus to the general employees by 5s. per week, as from Jan. 1. The question of hours was again postponed.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *March* 24.

In the London Market pitch continues in active demand, and the price of the article is quite firm; business being reported as having been done at well over 65s. per ton net at makers' works. Creosote is steady at from 6d. to 6¼d. per gallon; large sales having been made. There is little demand for solvent naphtha; the price being weak at from 2s. 6d. to 2s. 7½d. per gallon. Benzol continues in good demand for motor fuel purposes.

In sulphate of ammonia there is nothing new to report.

Tar Products in the Provinces.

March 24.

The average values for gas-works products during the week were: Gas-works coal tar, 36s. to 41s. Pitch, East Coast, 50s. to 51s. per ton f.a.s.; West Coast—Manchester 45s. to 50s., Liverpool 45s. to 50s., Clyde 45s. to 50s. nominal. Benzol 90 p.ct., North, 1s. 10d. to 1s. 11d.; 50-90 p.ct., naked, North, 1s. 9d. to 1s. 10d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha in bulk, North, 8¼d. to 8½d. Solvent naphtha, naked, North, 2s. 5d. to 2s. 6d. Heavy naphtha, North, 2s. 10d. to 2s. 11d. Creosote, in bulk, North, 5d. to 5⅛d. Heavy oils, in bulk, North, 6d. to 6½d. Carbolic acid, 60 p.ct. unsaleable. Naphthalene, £25 to £30; salt, £6 to £7, bags included. Anthracene, "A" quality, 4d. to 6d. per minimum 40 p.ct.; "B" quality, 1½d. to 2d.

FROM A MARKET CORRESPONDENT.

Tar Products.

Markets have been much disturbed during the past week by the prospects of a coal strike; and in the present state of uncertainty, very little is being done. London quotations for pitch are firmly maintained, and Provincial rates are generally a trifle harder. The market in the Provinces is still one of very mixed views; and the effects of a coal strike are somewhat difficult to gauge, as there are probably as many reasons why prices should fall as for a rise in value. But apart from a strike, although stocks are plentiful and shipments only get away slowly, considerable exports are expected shortly. Toluol is without change, and benzol is moving off freely as a motor fuel, although the Association's specification is not exactly to the liking of manufacturers, who would prefer something nearer the 90 p.ct. grade. Most producers are finding their local demands increasing; and they should have no difficulty in disposing of outputs in their districts. Dehydrated tars are in good request in fairly large quantities. Refined naphthalene is difficult to market in bulk, and quotations are lower; while crudes are inclined to droop. There is very little business in solvent naphtha; the anticipated demand from the rubber industry not having materialized as yet. Heavy and crude are without change. Creosote continues very strong, and in some quarters it is thought that efforts to buy in large lots are related to fears as to the supply of fuel. It is reported that 7d. per gallon has been made in the Provinces, and 6½d. can readily be obtained. Cresylic acid is quite inactive; but nominal quotations do not seem to vary. If there is any market at all for carbolic acid, it is difficult to find it; and one can only describe it as almost hopelessly depressed. Makers of crystal cannot now sell their product. Although some lots have been offered at 4d. per lb., there is no business for it, and holders are in a difficult position, and must face heavy losses. There is some talk of trying to fix 1s. 3d. per gallon in casks, or 1s. naked for crude. This is quite a pre-war price; but in the present position of crystals, there is no incentive to buy. Other products are without change.

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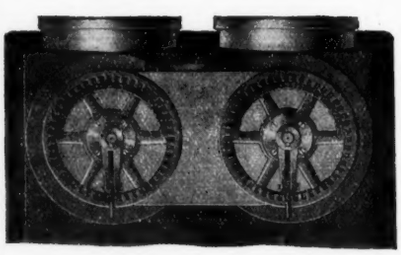

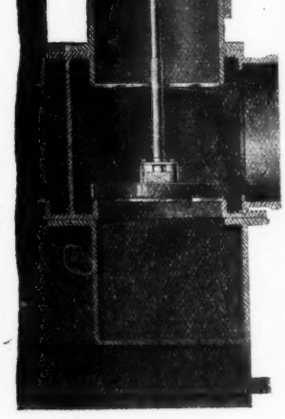

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Carbolic acid: Crude 60's unsaleable; crystals, 40%, 4d. per lb. asked.

Crude Tar: London, 40s. to 41s.; Midlands, 34s. to 36s.; North 35s. per ton *ex* works.

Pitch: London, 65s. to 70s. per ton; East Coast, 48s. to 50s. per ton; West Coast, 44s. to 45s., with Manchester 42s. per ton and Glasgow 47s. 6d. per ton; South Wales, 53s. per ton.

Solvent Naphtha: London, 2s. 8d. to 3s. Provinces average 2s. 6d. per gallon.

Crude Naphtha: Naked, 10d. per gallon.

Heavy Naphtha: 2s. 8d. per gallon.

Naphthalene: Refined, £20 to £22 per ton nominal; crude, £6 to £12, according to quality.

Toluol: Naked, 2s. 1d. to 2s. 3d. per gallon nominal.

Creosote: London, 7½d.; North, 6¾d. to 7d.; heavy oil, 7d. per gallon in bulk.

Anthracene: 40-45%, 4½d. to 8d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 per ton f.o.r. makers' works.

Aniline Oil: 1s. 2d. per lb.

Cresylic Acid: 95%, 2s. 9d. to 3s.; 97-99%, 3s. to 3s. 3d. *ex* works London; f.o.b. other ports.

Sulphate of Ammonia.

There is little change in the position in comparison with last week. The wet condition of the land is interfering very much with the application of fertilizers. But despite these drawbacks, the home demand has not lessened to any marked degree. The export trade is closely engaging the interest of manufacturers. The position is somewhat obscure, owing to the fact that very little is available for export, on account of the British farmers' own strong demands at the attractive official prices. Much, of course, depends upon developments in connection with nitrate of soda. Meantime, suggestions have been made for the transacting of export trade which meet with approval in many quarters. Among these are that the export trade should be continued through the known channels, in contrast with more or less doubtful trials by way of the Sales Committee. As I have often remarked before, our overseas trade will be much smaller than before the war; but such as remains to us must be cultivated and developed, and we must not overlook the fact that German supplies may, and in all probability will, be available for export in large quantities. It is satisfactory to find that the trade generally are watching developments, and are ready to take immediate advantage of any relaxation in the restrictions. Export prices have been up to £32 per ton this month. These were special transactions, and any freeing of exports would bring prices to foreign consumers down with a run. Future export quotations are difficult to fix; but probably £18 per ton would be a fair average.

Illuminating Engineering Society Dinner.

The Illuminating Engineering Society last Tuesday celebrated the completion of its ten years' existence by a dinner at the Trocadero Restaurant, at which Mr. A. P. Trotter presided. The toast of "The Illuminating Eng neering Society" was proposed by Mr. Thomas Goulden, the Senior Vice-President of the Institution of Gas Engineers (in the unavoidable absence of Mr. D. Milne Watson, the President of the National Gas Council), and seconded by Mr. C. H. Wordingham, the President of the Institution of Electrical Engineers. The speakers paid a tribute to the value of the impartial platform provided by the Society for the discussion of matters of common interest to gas and electrical engineers. Both the gas and the electrical industries were on the eve of great developments, and there might be many opportunities for further co-operation in the near future. Mr. Trotter replied, and emphasized especially the union of science and practical work exemplified by the proceedings of the Society, which was remarkable for the opportunities it afforded for joint deliberations by those who designed and manufactured lighting appliances and those who used them. Mr. F. W. Goodenough, in proposing the toast of "Kindred Societies," mentioned many instances of fruitful co-operation with other bodies. The toast was responded to by Sir George Beilby, F.R.S., Colonel J. Herbert Parsons, D.Sc., F.R.C.S., and Mr. A. A. Campbell Swinton. Mr. Leon Gaster, in proposing the health of "The Guests," referred to the cordial relations which had existed with various Government Departments during the war. Dr. T. M. Legge, H.M. Chief Inspector of Factories, replied.

Bury Lighting Estimates.—The various committees of the Bury Town Council during the past week have had under consideration their estimates of expenditure for the coming financial year. A big increase in the cost of public lighting is looked for, mainly owing to the resumption of the full lighting of the streets, and the higher cost of gas, electricity, and wages—the figures being £7683, as compared with £3677 last year.

Southgate and District Gas Company.—The Directors reported at the half-yearly meeting that, owing to the Rationing Orders, the sale of gas for the six months ended Dec. 31, compared with that for the corresponding period of the preceding year, showed a reduction of 7,997,900 c.ft., or 6·4 p.ct. This, together with the enhanced cost of coal and the increased wages, resulted in a large reduction of the revenue. The advance in the price of gas which took place as from Michaelmas last having been inadequate to meet the additional cost of manufacture and distribution, the Directors have decided to further increase the price by 2d. per 1000 c.ft. as from Lady-day. After providing for interest charges, &c., there remained a balance of profit of £4449; and the Directors recommended the declaration of dividends for the half year at the rates per annum (less income-tax) of 10 p.ct. on the original capital, and 7 p.ct. on the additional capital. This appropriation required the sum of £4325, and would leave a balance of £124 to the credit of the profit and loss account to be carried forward.

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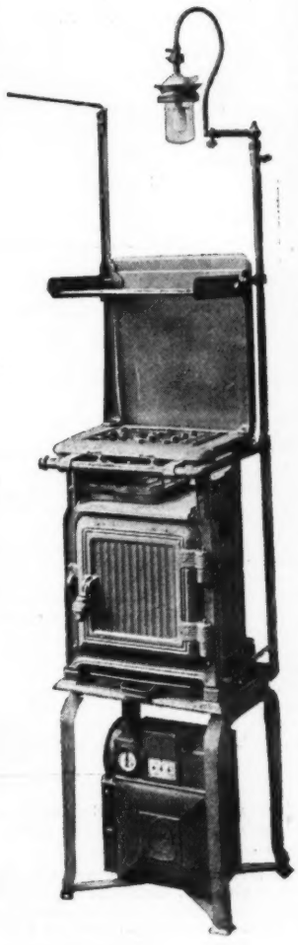

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A Bankrupt and a Burner Patent.

At the London Bankruptcy Court, on Tuesday last, before Mr. Registrar Mellor, the immediate discharge was granted of William George Temple, formerly carrying on business in partnership with F. B. Mills, as W. T. Temple & Co., No. 12, Kentish Town Road, N.W. A first and final dividend of 3s. 7d. in the pound had been paid to the creditors. For the first four years the firm were very successful; but afterwards they became interested in a patent incandescent gas-burner, invented by a man named Howell, and called the "Howelite." They made a verbal arrangement with Howell, under which they acquired a two-thirds interest in the patent, and agreed to finance the inventor. They expended a considerable sum, amounting to over £2000, in connection with the patent, advertising the burner, and in registering a company which proved abortive, because it never went to allotment. They were unable to realize their interest in the patent.

Presentation to a Military Medallist.

An interesting event took place at the Wakefield Gas-Works, in the form of a smoking concert and a presentation to Sergeant R. A. Walker, R.E., one of the gas-fitters employed in the distribution department. When Sergeant Walker was demobilized, his fellow-workers decided to make him a present, to commemorate the honour he had attained; and this was done at a social gathering in the shareholders' room at the offices in Warrengate, by permission of the Directors. Mr. H. Townsend (the Managing Director) presided, and was supported by Alderman P. Mountain and Mr. J. W. Hall (Directors); the Chairman (Alderman G. A. Moorhouse, J.P.), and Vice-Chairman (Mr. A. M. Lawrence) being unable to attend owing to illness. Mr. R. B. Wilson (the Secretary) first of all paid an appropriate tribute to those connected with the Company who had made the great sacrifice; and the Chairman then extended a cordial welcome to all the returned soldiers. He referred to the fact that 43 p ct. of the Company's employees had joined the Colours, a record that would compare favourably with that of any concern in the country. Alderman Mountain made the presentation of a case of cutlery and a silver cruet, which bore the inscription: "Presented to Sergeant Reginald A. Walker by the employers and employees of the Wakefield Gaslight Company on his gaining the Military Medal at Cambrai, 1917."

A Very Unusual Incident.

Under this heading, Mr. S. J. Ingram, the Engineer and Manager to the Truro Gas Company, relates as follows, in the "West Briton," an incident which, he says, deserves wide publicity: "A few weeks since, the Court of Arbitration adjudicated on a claim by the National Federation of General Workers for an increase in wages to their members in the gas industry; and their award has just been given, authorizing advances in wages of 5s. per week to adults and 2s. 6d. per week to juniors. As this award might affect the employees of the Truro Gas Company, I took an early opportunity of ascertaining their attitude in relation to the award, when I was informed that they had already considered the matter, and, having regard to the fact that they had always been considerately treated by the Directors of the Company, and that the Company were not profiteers, but, on the contrary, had suffered considerably under war conditions, they had unanimously decided, on the advice, and with the approval, of the officials of their Union, to forego the benefit of the award, and not to accept the increases of wages authorized. I think it will be generally conceded that this decision is splendid, and exhibits a spirit of consideration and self-sacrifice worthy of our warmest appreciation. And, when it is pointed out that to give effect to the award would have meant an increase of 3d. per 1000 c.ft. in the cost of gas, I feel sure this appreciation will be felt and shared by the whole of the citizens of Truro. Personally, I regard the incident as but one of very many expressions of loyalty and good comradeship shown during my nearly quarter of a century's association with the Truro gas undertaking."

Increase in Price at Southgate.—The Southgate and District Gas Company intimate a further increase in the price of gas of 2d. per 1000 c.ft.

Reduction in Maintenance Charges.—In a letter to the Lambeth Borough Council, the South Metropolitan Gas Company say that the charge for the maintenance of public street lamps will be reduced by 12s. per lamp per annum as from Lady Day. Since the restrictions have been relaxed, the number of lamps in lighting has been considerably increased—in one or two districts the whole of them are in use. This, of course, tends to reduce the average of labour costs; and, though the present conditions do not warrant the reduction above indicated, the Directors have decided to anticipate the return to full lighting generally, and give the authorities the advantage of the saving that it is expected will eventually be effected.

Increase in Price at Hebden Bridge.—It has been decided by the Hebden Bridge and Mytholmroyd Gas Board to advance the price of gas 1s. per 1000 c.ft. from April 1, and to charge prepayment meter users at the rate of 1d. for 14 c.ft., with a discount of 3d. per 1000 c.ft. Mr. A. Sutcliffe, in explaining the reason for the increase to 5s. 3d. per 1000 c.ft., said the Board had practically no control over the circumstances. The pre-war price was 3s.; and they could congratulate themselves that, up to the present, it had only been advanced to 4s. 3d. The coal required during the year would involve an extra expenditure of £5200, the wage bill would shortly be £4300 more than in pre-war time, rates and taxes would be £1000 more, and another £1000 was involved in other requisites. Altogether during the coming year there would be an extra expenditure of £11,500 to meet—practically 2s. 5½d. per 1000 c.ft. The extra 1s. 3d. per 1000 c.ft. to be charged would bring in £3000, and residuals £2000; and the make per ton had increased from 12,700 c.ft. to 14,000 c.ft.

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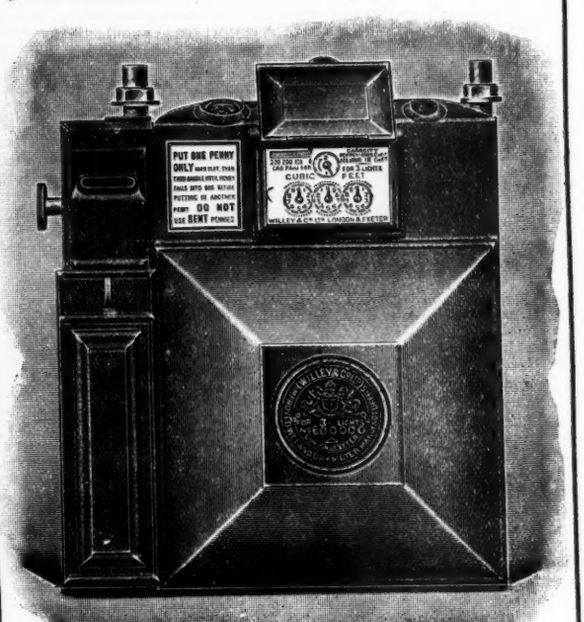

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Price of Gas at Hull.—The British Gas Light Company, Ltd., announce at Hull that advances in the cost of labour, coal, and all materials have compelled them to advance the price of gas to 4s. per 1000 c.ft. from and after the reading of the meters for the Lady-Day quarter. In pre-war times, the price was 1s. 10d.; and this is the fourth advance made since then.

Drogheda Gas-Works' Management.—The Drogheda Corporation last week accepted the resignation of Mr. H. W. Saville, who has been Manager of the gas-works for the past twelve years. Mr. Callan suggested that a young man should be trained under Mr. Saville's successor, so as to be qualified in a few years to join the ranks of Irish gas managers. The suggestion was approved; and it was mentioned that the Corporation might offer a scholarship through the technical school. The "Drogheda Independent" stated that "everyone competent to form a disinterested opinion knew, when the terms of the deal with the old Drogheda Gas Company were revealed, that the Corporation had made a remarkably soft bargain. The gas-works were acquired at a price very much in excess of their intrinsic worth; and one of the consequences had been that they have ever since been worked under a handicap of considerable weight."

Vertical Retort Scheme for Dundee.—It has been decided by the Dundee Corporation Gas Committee to recommend the acceptance of an offer by the Woodall-Duckham Company, Ltd., for the erection of a vertical retort installation at a cost of £37,275. Mr. Alex. Yuill (the Engineer), comparing verticals with horizontals, said he was certain that, had it not been for the introduction of the verticals now existing, the price of gas in Dundee, instead of being 3s. 3d., would have been 4s. per 1000 c.ft. The Convener (Mr. High) also remarked that it had been proved up to the hilt that the vertical retort system was the proper one. Lord Provost Don thought perhaps they might get the installation cheaper by waiting a little time; but Mr. High retorted that the saving in working for one year would make up for the difference in the event of a fall in prices. Lord Provost Don questioned whether they would be allowed to incur this capital expenditure in times like the present. To this, Mr. Yuill answered that the Government were anxious that work should be undertaken to give employment to the unemployed. If the Dundee Corporation were able to show that they could save 16,000 tons of coal and £8000 of money by vertical retort working, it was the Government who, in the event of refusal, would have to give the explanation.

STOCK MARKET REPORT.

LAST week the Stock Exchange had a very dull opening, and business was severely repressed by all the doubts and fears which had weighed markets down the preceding week and saw them almost crushed at the close. These need not be recapitulated—they are fairly seared into all minds. But ere long there were signs of reaction apparent, and that hope which springs eternal in the human breast imparted a tone which approximated cheerfulness at the close. Its justification may (and let us hope will) be apparent later on.

In the gilt-edged market, however, Home Government issues were weak. War Loan managed very nearly to recover its position on Friday; but Consols and other loans were down. Indian issues receded. Home Rails, however, after a poor start, came well to the front, and closed at a fair advance. Canadian Grand Trunk had a like career, and Argentines advanced. In the Foreign Market, French Loans gave way again on Exchange movements; but Japanese and Brazilian were firm. In Miscellaneous, there were ups and downs; many lines being depressed by the labour question. Business in the Gas Market was in the aggregate perhaps a shade more active than the previous week; but it was almost entirely concentrated in Gas Light and Coke and Imperial Continental, with a small contingent of South Metropolitan bargains. All the rest contributed barely a score of transactions between them. In the Metropolitans, Gas Light ordinary was 1 lower; but all the other issues were firm. South Metropolitan had a fall of 2½; but Commercial was not dealt in. In Provincials, Alliance and Dublin rose 1, and Sheffields were fractionally better on *ex div.* quotations. Primitivas were heavy on the unpromising aspect of affairs in Buenos Aires.

Bargains done for cash during the week were as follows: On Monday, Cape Town debenture 61, European 12½, Gas Light ordinary 64, 64⅜, ditto maximum 55⅜, ditto preference 69½, 70, 70½, 70⅜, 71, Imperial Continental 116⅝, 116⅞, 117, 117¼, 117½, 117⅜, 118, Primitiva Preference 50s., South Metropolitan 66, 67, Alresford 17s. 6d. On Tuesday, Alliance and Dublin 50, 50¼, Gas Light Ordinary 63½, 63⅝, 63⅜, 63⅝, 64¼, ditto maximum 55⅛, 56, 56½, ditto preference 70, 70⅛, ditto debenture 56½, 57, ditto 10 p.ct. bonds 169½, 170, Imperial Continental 116, 117, 117½, 118, Primitiva preference 50s., San Paulo preference 7⅛, South Metropolitan 66, South Suburban 77⅛, Southampton 70¼, Wandsworth "C" 68, Farnham 7 p.ct, 6⅜, 6 7/16, Worthing Consolidated 59, 59½. On Wednesday, Cape Town debenture 65, Continental Union 48, Gas Light ordinary 63, 63⅛, ditto preference 71, Imperial Continental 116½, 117, 117⅛, 117⅜, 117¾, Maidstone 59⅜, 60½, Monte Video 9 13/16, South African 13, San Paulo preference 7⅛, South Metropolitan 64, 64⅛, South Suburban 78, 78¼. On Thursday, Gas Light ordinary 63, 64, ditto preference 70⅜, Imperial Continental 116, 116½, 117, South Metropolitan 64⅛, York Town 11, 11⅛, ditto 7 p.ct. 7⅛, 7 15/16. On Friday, Bombay 6⅛, British 32½, Gas Light ordinary 62½, 62⅜, 63, ditto preference 70½, Imperial Continental 116⅛, 117, 117¼, South Metropolitan 64, 64⅛, 64⅜.

In the Money Market there was a large demand, and rates steadily hardened; reaching their highest on Friday, but easing somewhat before the close of the day. The bank rate is 5 p.ct., as fixed on April 5, 1917.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share.	When last Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices. July 30. 1914	Present Prices.	Lowest and Highest Prices of Bargains.
189,049	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	62 –67*	..
1,551,968	"	April 8	2½	4⅜	Alliance & Dublin Ord.	59–64	49–51	50–50½
874,000	"	July 10	4	4%	Do. 4 p.c. Deb.	76–79	61–63	..
230,000	5	April 29	7½	8%	Bombay, Ltd.	5⅞–6⅜	5⅞–6⅛	6⅛
50,000	10	Feb. 26	16	12⅜	Bournemouth Gas and Water { 10 p.c.	29–30	24–28	..
888,110	10	"	7	7%	B 7 p.c.	15–15½	10–11	..
115,000	10	"	6	6/-	Pref. 6 p.c.	13½–14	9–9½	..
159,740	—	—	—	4%	4 p.c. Deb.	..	66–68	..
992,845	Stk.	Feb. 26	14	37/-	Brentford A Consolid.	261–266	76–79	..
784,290	"	"	11	31/8	Do. B New	204–209	70–76	..
55,000	"	"	5	6%	Do. 5 p.c. Pref.	109–111	75–80	..
221,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91–93	64–66	..
217,880	"	Feb. 26	11	7½%	Brighton & Hove Orig.	208–218	140–145	..
344,200	"	"	8	6⅛%	Do. A Ord. Stk.	154–159	97–102	..
988,500	Stk.	"	5	5%	Bristol 5 p.c. max.	..	..	..
530,000	20	Mar. 26	12½	10%	British	44–45	31½–32½	32½
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88–90	64–66	..
245,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	85–87	50–53	..
100,000	10	—	—	—	CapeTown & Dis., Ltd.	1½–2½	3⅜–4½	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4–6	7½–8½	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70–75	60–65	61–65
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108–110	..	..
1,518,980	"	Feb. 12	5/9/4	80/-	Commercial 4 p.c. Stk.	106–108	62–65	..
860,000	"	"	5½	26/3	Do. 3½ p.c. do.	103–105	59–62	..
475,000	"	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½–71½	51–53	..
800,000	"	"	4	—	Continental Union Ltd.	76–79	48–53	48
200,000	"	"	7	—	Do. 7 p.c. Pref.	115–118	70–75	..
51,600	Stk.	Aug. 29	14½	12½%	Croydon A 10 p.c.	..	155–165	..
278,400	—	"	11½	9½%	Croydon B and C 7 p.c.	..	130–135	..
493,270	Stk.	—	6	5½%	Derby Con. Stk.	128–130	..	..
55,000	"	—	4	4%	Do. Deb. Stk.	102–104	..	..
1,009,180	10	July 29	10	5/0	European, Ltd.	17½–18	12½–13½	12½
16,298,975	Stk.	Feb. 10	4/17/4	80/-	Gas Light and Coke { 4 p.c. Ord.	98–102	62–64	63¾–64⅜
2,600,000	"	"	8½	26 8	3½ p.c. max.	76–79	55–57	55⅞–56½
4,069,295	"	"	4	4%	4 p.c. Con. Pref.	96–99	70–72	69⅝–71
4,674,850	"	June 11	3	3%	3 p.c. Con. Deb.	72½–74½	56–58	56⅝–57
180,000	"	"	10	10%	10 p.c. Bonds	..	..	169½–170
82,500	"	Mar. 12	6	4½%	Hastings & St. L. 5 p.c.	..	59–64*	..
258,740	"	—	3½	2⅜%	Do. 3½ p.c.	37–39	44–49*	..
70,000	10	April 29	11	8%	Hongkong & China, Ltd.	16½–16⅝	7⅜–8⅜	..
86,600	Stk.	Sept. 12	9	8⅛%	Hornsey 7 p.c.	..	115–130*	..
181,000	"	Mar. 12	7½	6⅞%	Ilford A and C.	151–154	90–95*	..
65,780	"	"	6⅝	4½%	Do. B	115–118	69–74*	..
66,800	"	June 26	4	4%	Do. 4 p.c. Deb.	92–94	62–65	..
4,940,000	"	May 14	9	4½%	Imperial Continental	150–160	116–121	116–118
1,295,000	"	Feb. 12	3½	3⅛%	Do. 3½ p.c. Deb. Red.	84–86	72–74	..
285,342	"	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119–121	93–98	..
2,498,905	"	Feb. 26	10	42/6	Liverpool 5 p.c. Ord. { A	211–218	..	..
					{ B	146–148	..	..
806,068	"	June 26	4	4%	Do 4 p.c. Pr. Deb. Stk.	..	..	..
165,736	"	Feb. 17	7/5/6	33⅜%	Maidstone 5 p.c.	..	58–62	59½–60½
75,000	5	June 11	6	3%	Malta & Mediterranean	4½–4⅝	5½–5⅝	..
250,000	100	April 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99–101	90–97	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½–12	9⅜–9⅞	9½
1,875,892	Stk.	July 29	4½	8½%	Newcastle&Gatsh'd Con.	96½–99½	70½–71½	..
599,705	"	June 26	8½	8⅜%	Do. 3½ p.c. Deb.	8½–8⅝	6⅞–6⅞	..
55,940	10	Feb. 26	7/14/0	7/0	North Middlesex 7 p.c.	14–15	9½–9⅞*	..
900,000	Stk.	May 14	8	8%	Oriental, Ltd.	117–122	103–106	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7⅛–7⅜	4⅞–5⅛	..
60,000	50	Feb. 26	18	7½%	Portsea, Island B	128–131	76–81	..
100,000	50	"	12	6⅜%	Do. C	118–121	68–73	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅛–6	1¼–1⅜	..
499,960	5	June 26	5	—	Do. 5 p.c. Pref.	4⅞–5	2¼–2⅝	50/-
651,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91–98	74–76	..
600,000	Stk.	July 31	4	4%	Do. " " 1911	..	46–49	..
846,198	"	June 26	4	4%	River Plate 4 p.c. Deb.	86–87	48–52	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½–11	7⅜–8⅛	7⅜–7⅞
125,000	50	July 1	5	5%	{ 5 p.c. Deb.	47–49	40–42	..
185,000	Stk.	Mar. 12	10	5%	Sheffield A	238–234	83–85*	..
209,984	"	"	10	5%	Do. B	222–234	83–85*	..
523,500	"	"	10	4⅞%	Do. C	220–222	82–84*	..
133,201	Stk.	Sept. 12	4	4%	Shrewsbury 5 p.c.	..	..	..
90,000	10	May 28	9	6/-	South African.	10½–11½	13–14	13
6,609,895	Stk.	Feb. 10	5/4/0	80/-	South Met. 4 p.c. Ord.	111–113	64–67	64–67
250,000	"	July 12	—	5%	Do. Pref.	..	95–97	..
1,895,445	"	July 10	3	3%	Do. 5 p.c. Deb.	72½–74½	54–56	..
224,820	"	Feb. 26	8½	5%	South Shields Con. Stk.	157–159	112–114	..
962,795	"	"	6	3⅞%	S'th Suburb'n Ord. 5 p.c.	114–116	76–79	77½–78½
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116–118	89–93	..
647,740	"	May 14	3	3%	Southampton Ord.	99–102	69–71	70½
190,000	"	Feb. 12	7½	4½%	Tottenham { A 5 p.c.	135–138	90–95	..
789,276	"	"	6	3%	District { B 3½ p.c.	115–117	65–67	..
181,255	"	June 26	4	4%	{ 4 p.c. Deb.	87–89	64–66	..
182,880	10	Dec. 30	5	—	Tuscan, Ltd.	5–6	1–2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93–95	45–50	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	108½–109	85–86*	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	"	Feb. 26	8⅜	55/-	Wandsworth A 5 p.c.	151–155	88–93	..
255,686	"	"	6⅜	40/-	Do. B 3½ p.c.	129–134	68–73	..
104,075	"	"	—	38/6	Do. C	..	68–73	68
140,865	"	"	—	34/6	New Ordinary	..	68–73	..
353,000	"	"	6⅜	38/9	Wimbledon 5 p.c.	117–122	69–73	..
98,000	"	"	6⅜	40/-	Epsom 5 p.c.	121–126	70–75	..
88,416	"	June 26	3	3%	3 p.c. Deb. Stk.	66–69	50–52	..

* *Ex div.*

Dartmouth Gas Company.—The shareholders of the Dartmouth Gas Company held their annual meeting on Friday—Mr. H. Adams presiding. The profit for the year amounted to £1351, after charging to revenue all renewals, repairs, maintenance, and depreciation. Dividends of 5 p.ct. on the second preference shares and of 8½ p.ct. on the ordinary shares (both less income-tax) were approved.

Dublin Gas-Workers Strike Averted.—The threatened strike of the Alliance and Dublin Consumers' Gas Company's workers, including those at Kingstown and Bray, has been averted. Mr. Gordon Campbell, Irish Secretary, Ministry of Labour, presided at a conference, at which it was agreed that the men should have a 47-hour week, and wages increases of from 5s. to 8s., with rate-and-a-half for overtime and double rates for Sundays.

Importation of Gas-Mantles.—Referring to the withdrawal by the Government of the general licences permitting the importation into this country of gas-mantles, the "Ironmonger" says: The revocation of the general import licence in the case of gas-mantles, on the other hand, appears to have come as a surprise to the makers in this country, who, despairing of moving the Board of Trade in the matter, had of late relaxed their efforts to secure the exclusion of imported goods. Needless to say, the restoration of the embargo upon imported mantles, though unexpected, is none the less welcomed by the British manufacturers, who claim to be in a position to supply all the country's requirements. It must be borne in mind, however, that the cancellation of the general licences referred to does not necessarily mean that no further supplies of gas-mantles will reach this country from abroad. The effect of the cancellation is merely to revive the necessity for an importer to obtain a licence before he is able to import the goods mentioned; and the manufacturers even now have no definite assurance that the Government will not, by freely granting import licences, take away with its left hand what it is giving with its right.

Cooker and Meter Rents at Bingley.—The Gas Committee recommended, at last week's meeting of the Bingley Urban District Council, that rents for the hire of gas cookers and meters should be increased by 25 p.ct. Mr. Leach thought an all-round increase was hardly fair, and suggested its application only to new meters and cookers. Mr. Turner (the Chairman of the Committee) said this point had been considered; and the unanimous decision was that an all-round increase was the most equitable way of meeting the situation created by the extra cost of these appliances. The minutes were approved.

It is announced that the price of gas supplied by the Wilmslow and Alderley Edge Gas Company is to be increased 6d. per 1000 c.ft.

James Graham, of Sheffield, having been depressed after the death of his mother, placed in his mouth one end of a tube the other end of which was attached to an open gas-bracket. The Coroner's Jury returned a verdict of "Suicide while sufferiag from depression."

There were fifty applications for the new position of Chemist for the Glasgow Corporation Gas Department, whose special duties will be to deal with the residual products of the gas-works. A short list of ten has been drawn up.

The old-established firm of Messrs. Thomas Piggott & Co., Ltd., Atlas Works, Spring Hill, Birmingham, who during the past half century have successfully carried out very large contracts for gas and water undertakings, has shown considerable enterprise in developing for post-war trade the manufacture of all coke-oven and chemical engineering plant formerly obtained from the Continent. Renewals of existing plant will be one of their specialities; and owners of coke-ovens or chemical plants will only need to state their requirements in terms of "Product" production, to obtain particulars or quotations for their requirements. Such plant as heat exchangers, preheaters, condensers, dephlegmators, door-lifting winches, &c., will be stocked.

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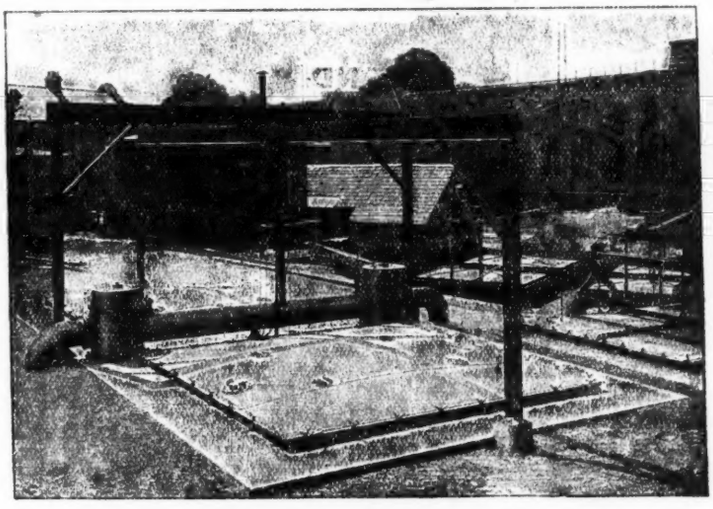

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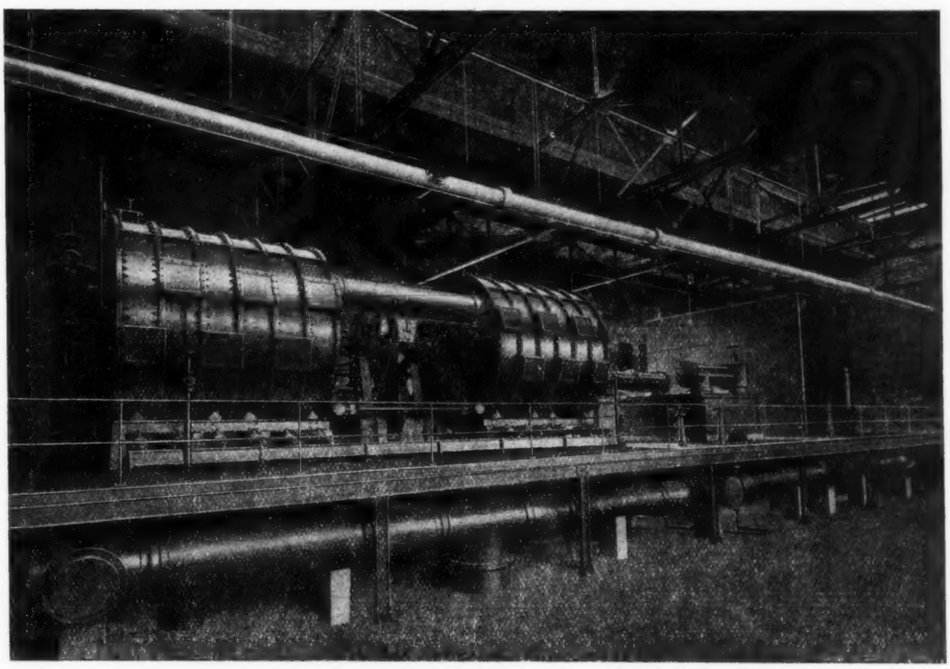

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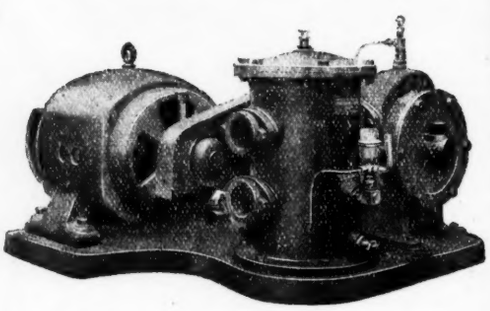

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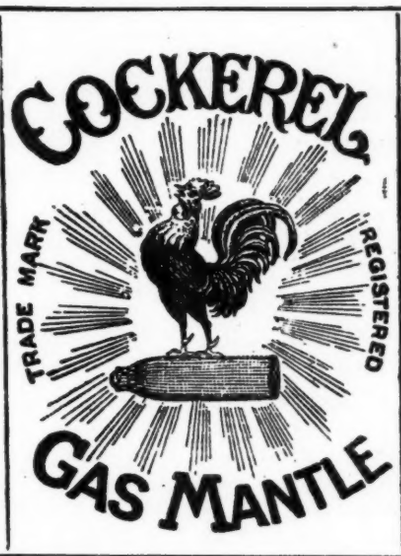

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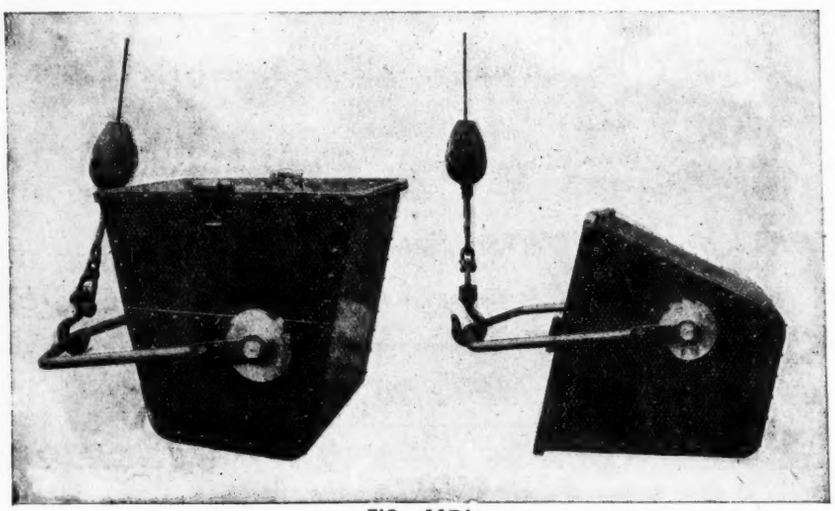

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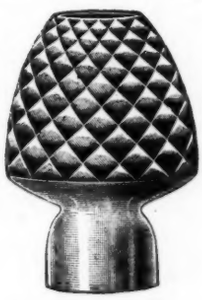

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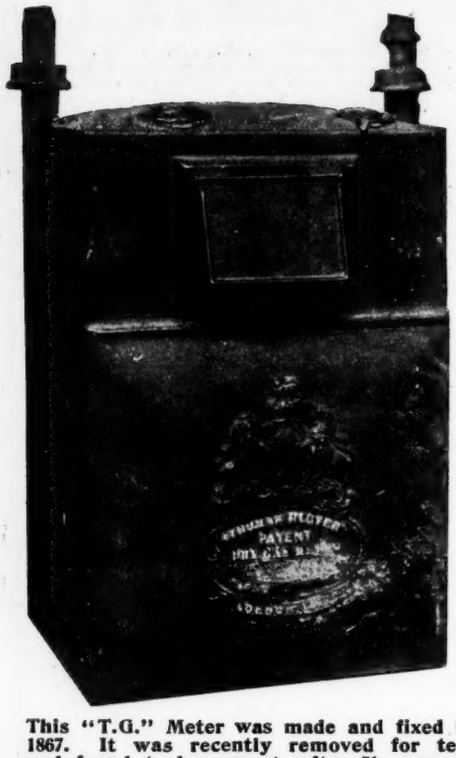

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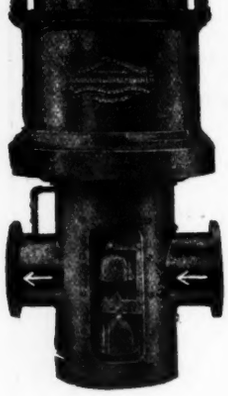

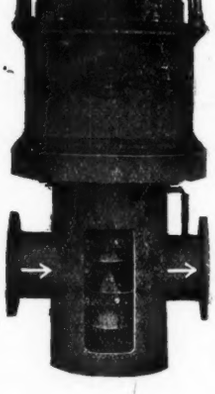

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ASSISTANT ENGINEER.

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WANTED for a London Suburban Gas Company making 500 Million Cubic Feet per Annum, a First-Class MECHANIC FITTER fully Conversant with Gas-Works Machinery. One able to operate a Lathe preferred.
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WANTED.—Leading Stoker able to Take Charge of Boiler and Exhauster. Wages, including War Bonus, per week of seven 8-Hour Shifts, £4 14s. 2d.
Apply to the MANAGER, GAS-WORKS, ABERTILLERY, MON.

PLANT, &c., FOR SALE & WANTED.

FACTORY Premises required between now and July, 1920, about 12,000 feet, within 20 miles of Charing Cross—South or West. Scientific Instrument business.
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TWELVE-TON Acid Tank Wagon for HIRE.
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WANTED—Condensers, Scrubber, or Scrubber-Washer, Half-Million to Three-Quarter Million Capacity each.
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THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the Construction and Erection of the following Plant at their Longford Works.
Contract No. 1.—BRICKWORK and FOUNDATIONS for a Generator, Engine, and Boiler House.
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Contract No. 4.—BOILER CHIMNEY.
The Drawings may be seen at the Gas-Works, Warrington, or at the offices of the Engineer, Mr. Wm. Newbigging, 5, Norfolk Street, Manchester. Copies of the Specification and Bill of Quantities may be obtained from the latter on Application.
Sealed Tenders, to be endorsed in accordance with the instructions contained in such Specifications or Bill of Quantities and addressed to the Chairman of the Gas Committee, Town Hall, Warrington, must be received by him not later than April 6.

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MESSRS. A. & W. RICHARDS beg to notify that they hold PERIODICAL SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES.
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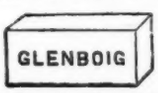
TRADE 

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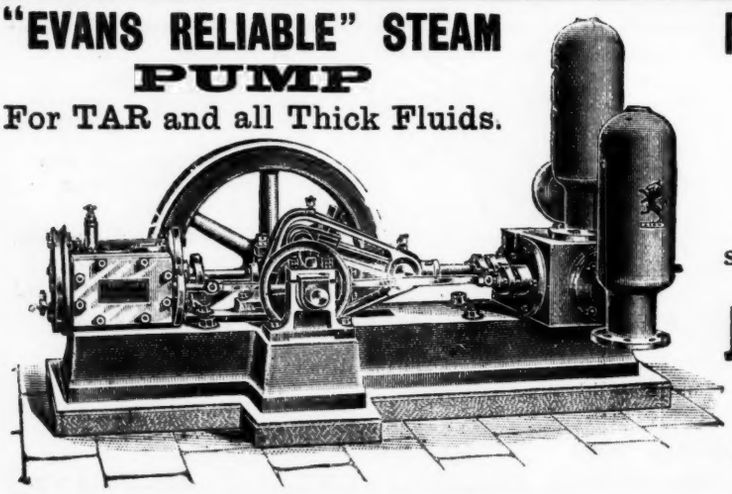

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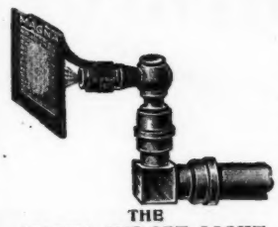

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Consumes only half a cubic foot of gas per hour, and therefore, reckoning gas at 3/4 per thousand, gives 50 hours of good light for a penny.

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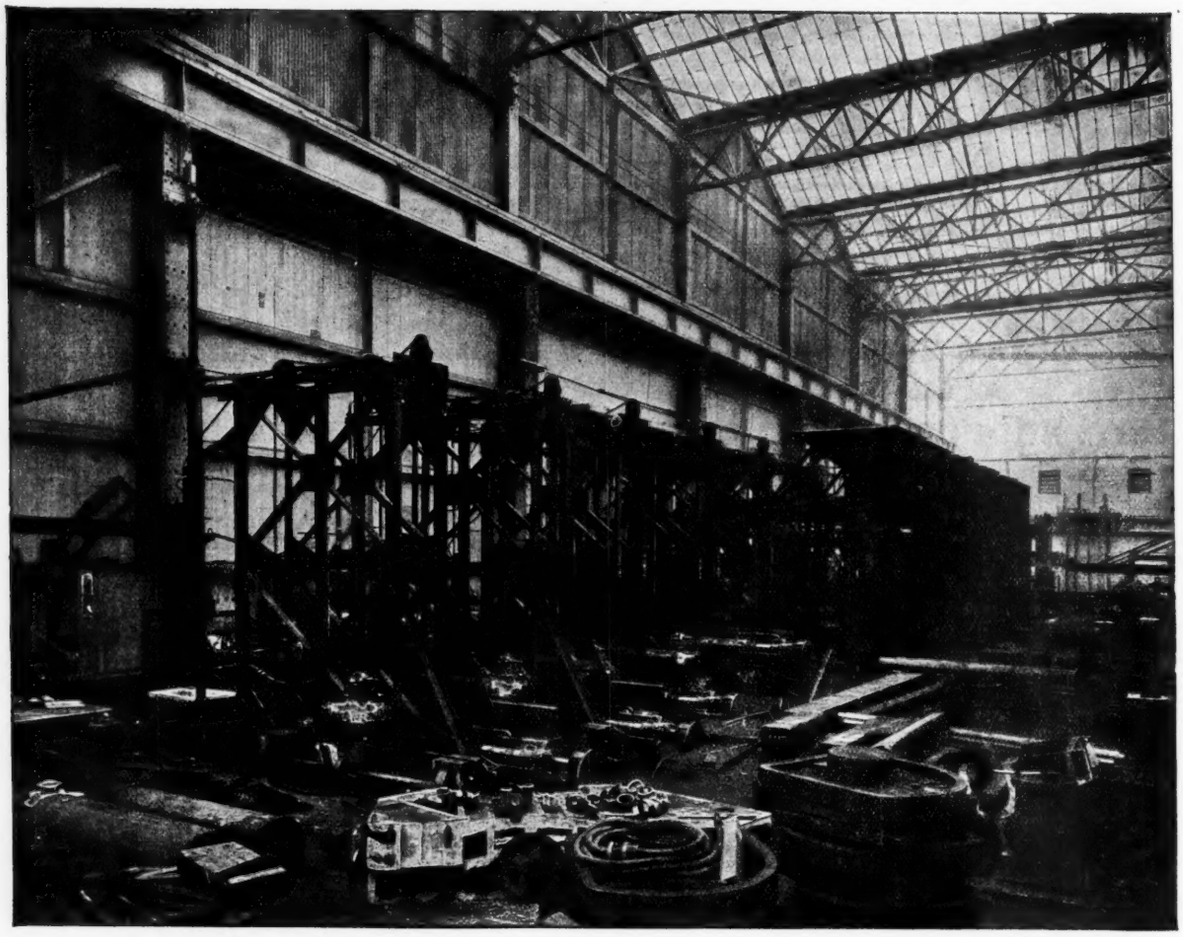

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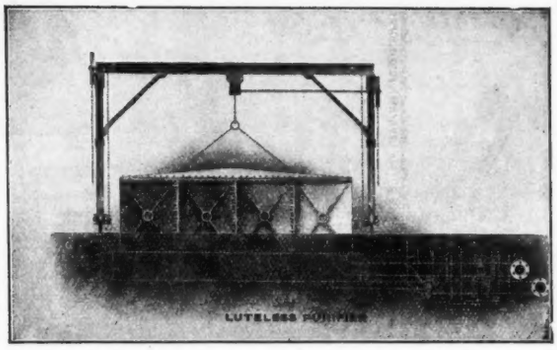
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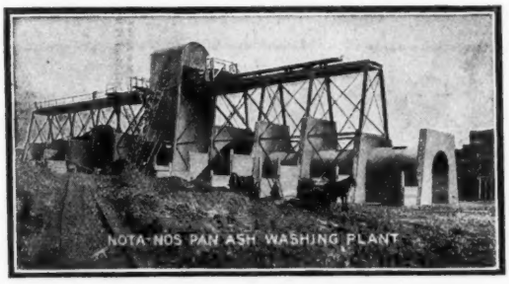
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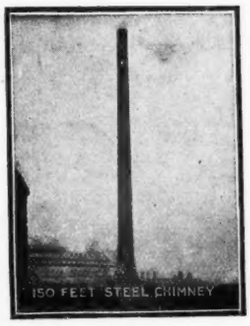
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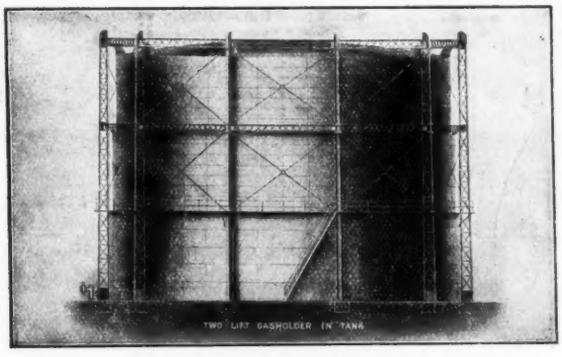
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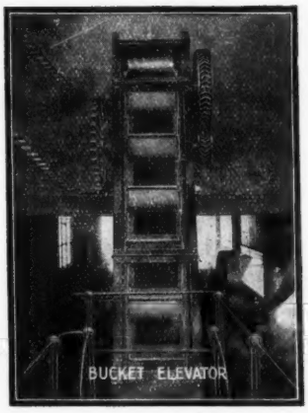
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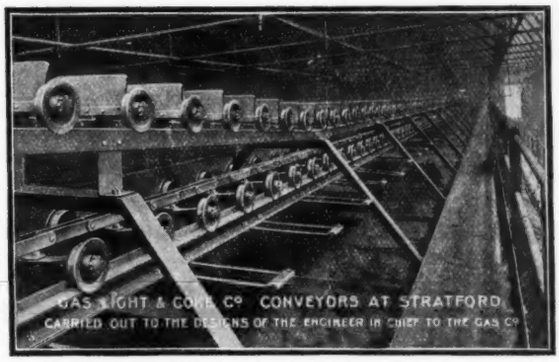
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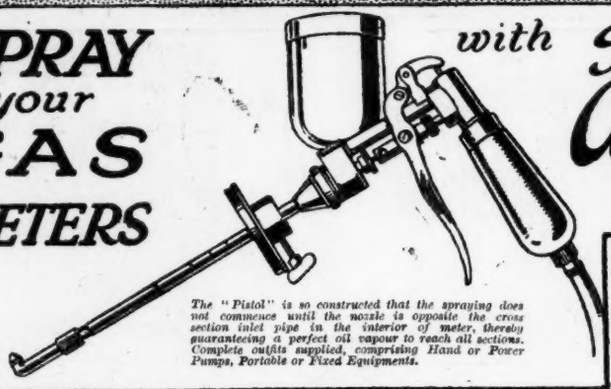

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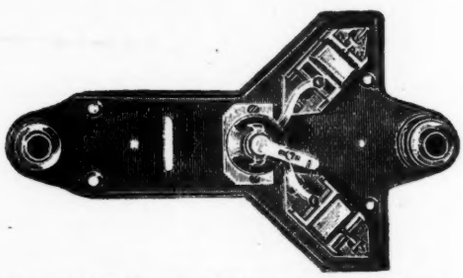

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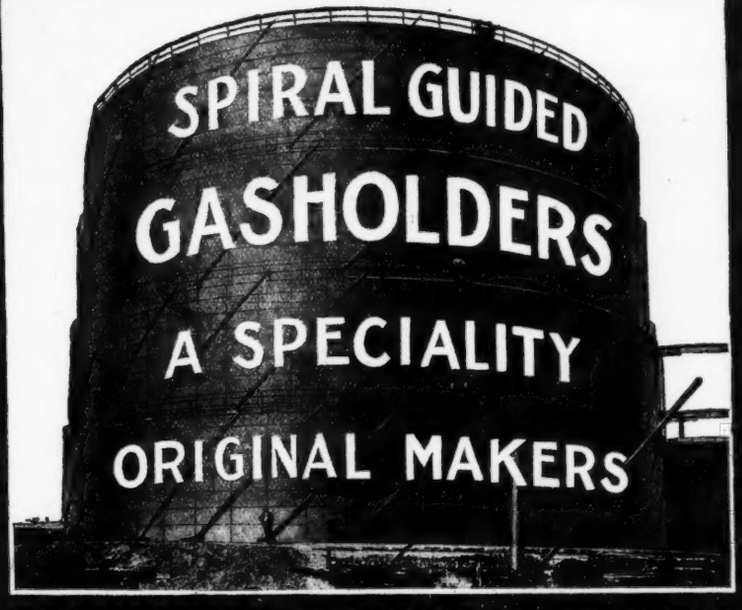

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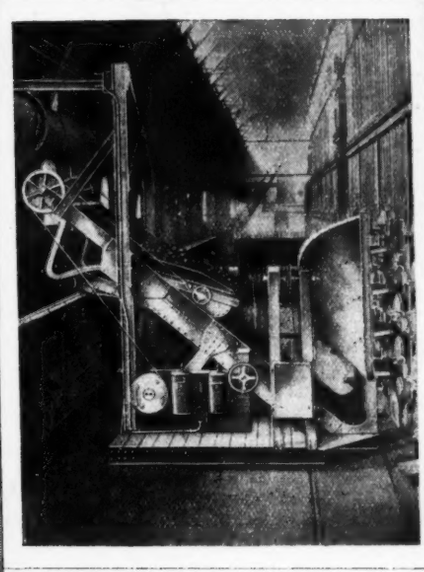

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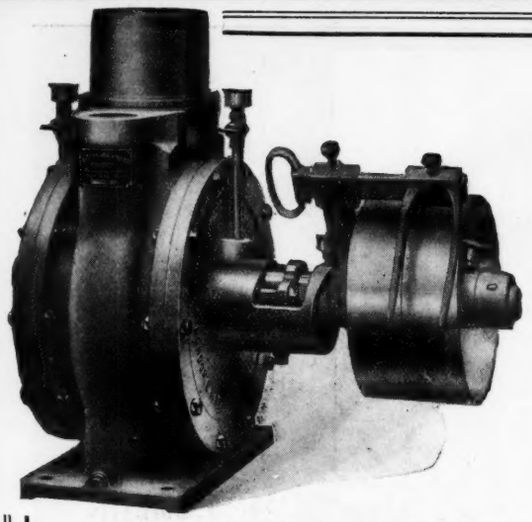

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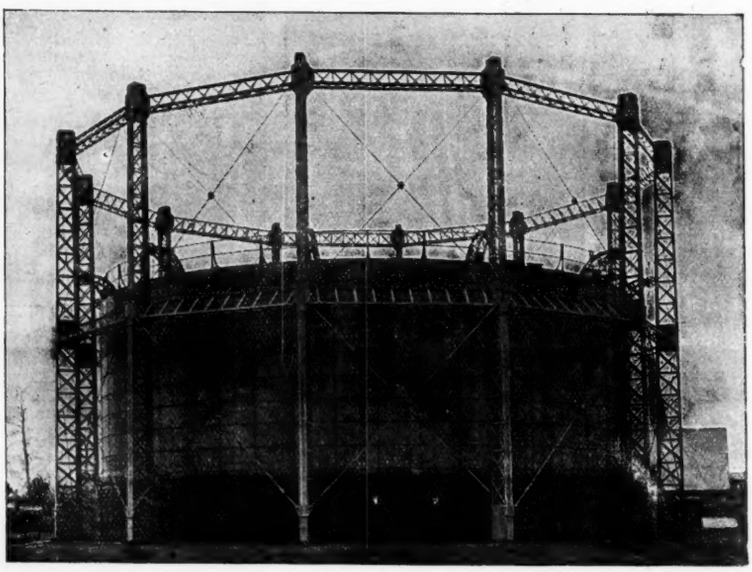

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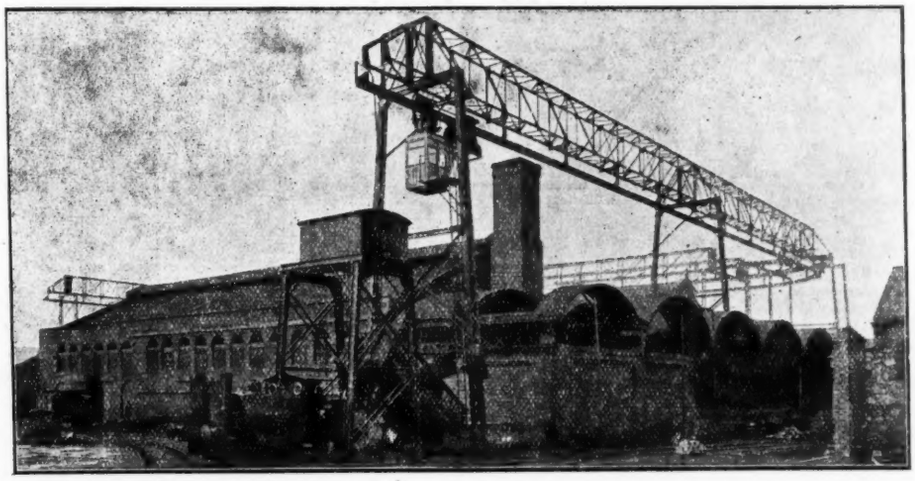

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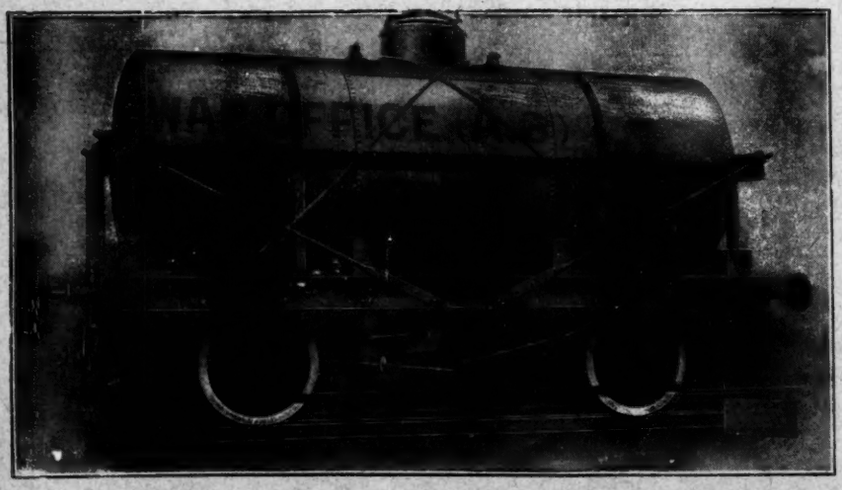

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